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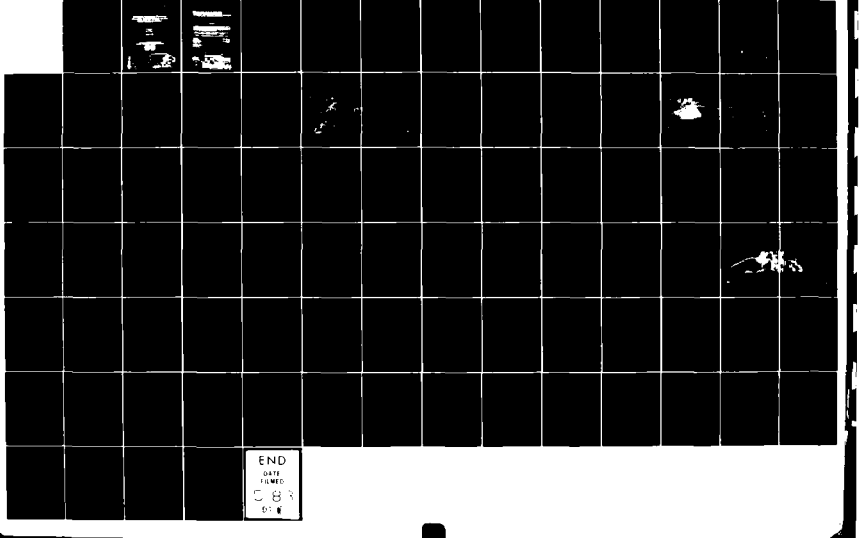

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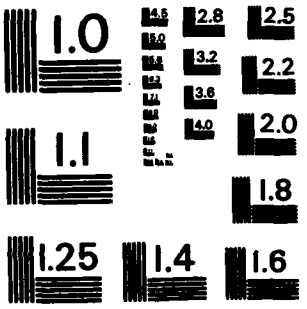


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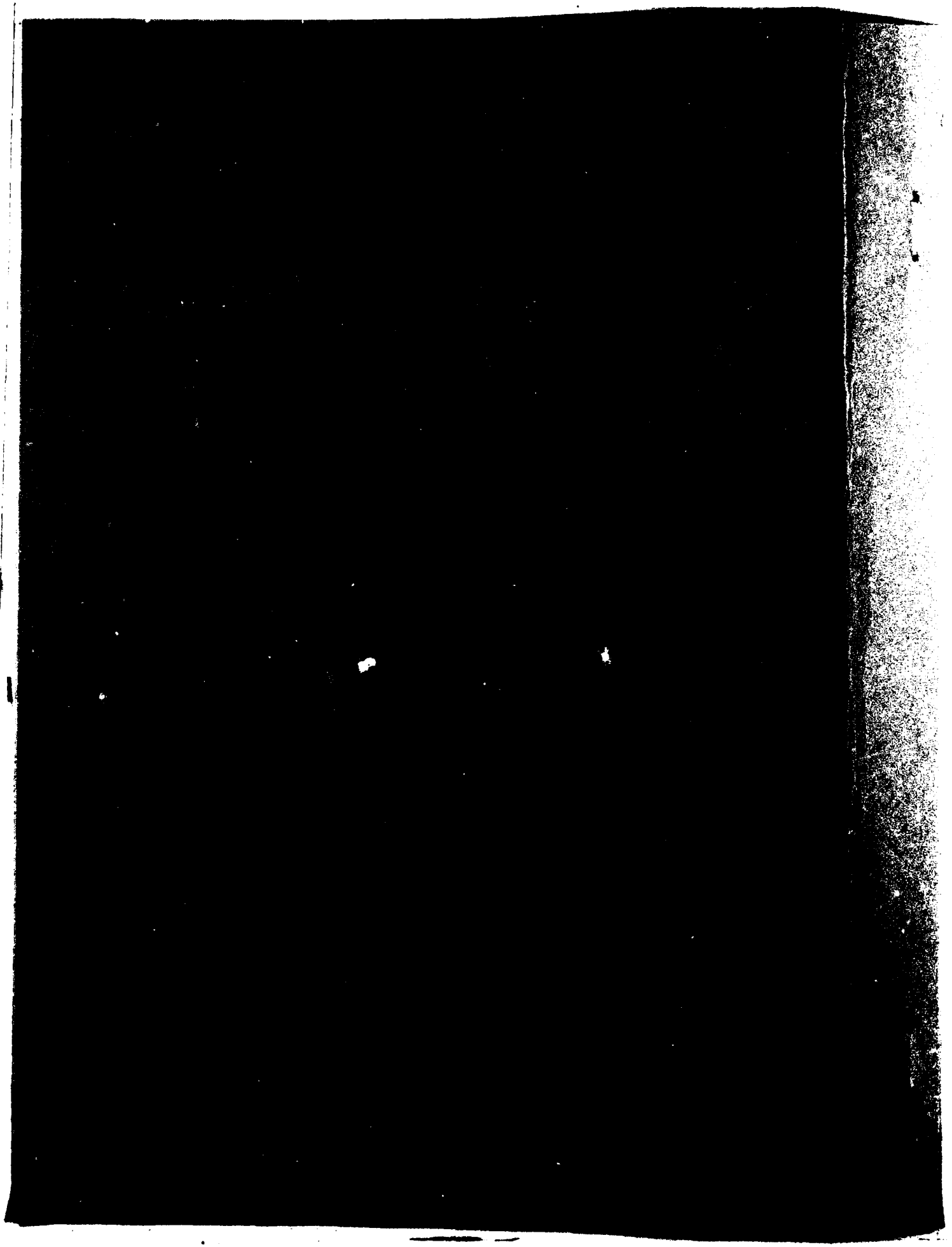

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(U) *Biological Resources Survey of Mountain Springs Canyon on the Naval Weapons Center*, by WESTEC Services, Inc., for the Public Works Department. China Lake, Calif., Naval Weapons Center, March 1983. 82 pp. (NWC TP 6424, publication UNCLASSIFIED.)

(U) A biological resource study of the 8500-acre Mountain Springs Canyon, located within the confines of the Naval Weapons Center, was conducted in May 1982 to update the general biological data base for the Center and to gain specific information about the study area for future resource management considerations.

(U) Seven vegetative habitats were identified: Creosote Bush scrub, *Grayia-Lycium*, *Artemisia-Coleogyne*, *Haplopappus-Coleogyne*, desert wash, riparian woodland, and pinyon pine woodland.

(U) Sixty-five bird species were observed, with the riparian areas and associated upland habitat supporting the majority of the species. State-endangered species observed included the Inyo Brown Towhee and Bell's Vireo. Few raptors were noted.

(U) Thirteen species of small mammals were captured and several reptilian species were observed. No amphibians were found.

(U) The entire Mountain Springs Canyon area is regarded as a sensitive habitat. The most sensitive areas within the canyon are the riparian woodland, pinyon pine islands, creosote rings, and an abandoned mine-tunnel containing a population of Townsend's Big-Eared Bats, a declining species.

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## SUMMARY

A biological resource study of the 8500 acre Mountain Springs Canyon within China Lake Naval Weapons Center was conducted in order to update the general biological data base for the Weapons Center as well as to gain specific information about the study area for future resource management considerations. Vegetative surveys included vegetative mapping, quantitative analysis through the use of belt transects and directed surveys for sensitive plant species. Avian surveys included use of Emlen transects within two upland habitats and use of modified strip/belt transects in three riparian zones. Directed surveys for raptors were also conducted. Quantitative evaluations of small mammals were conducted using the assessment line technique. Qualitative studies for large mammals, bats, reptiles and amphibians were also conducted.

Seven vegetative habitats were identified: Creosote Bush scrub, Grayia-Lycium, Artemisia-Coleogyne, Haplopappus-Coleogyne, desert wash, riparian woodland, and Pinyon Pine woodland. Most notable was the well-developed riparian vegetation within the canyon area. Creosote rings were found within the Creosote Bush scrub community. No sensitive plant species were found.

Sixty-five bird species were observed in the study area. The riparian areas and associated upland habitat supported the majority of the species. The state endangered Inyo Brown Towhee was observed in three larger expanses of riparian vegetation. Several other species regarded as sensitive also occur in this habitat including the Bell's Vireo. Bell's Vireo is potentially the state endangered subspecies. No nesting raptors were found and few raptors in general were noted.

Thirteen species of small mammals were captured during the survey. These species included a subspecies of the Panamint Kangaroo Rat that is endemic to the region. Other species observed directly or indirectly included rabbits, hares, Bobcat, Coyote, Kit Fox, and Mule Deer. A population of Townsend's Big-eared Bat was found in an abandoned mine shaft. Several reptilian species were observed. No amphibians were found.

The whole Mountain Springs Canyon area is regarded as a sensitive habitat. Riparian areas, pinyon pine islands, creosote rings, and a mine tunnel containing a maternal colony of bats were identified as most sensitive. General management recommendations were also provided.

# SECTION 1
# INTRODUCTION

## 1.1 STUDY SCOPE

WESTEC Services, Inc., under contract to the China Lake Naval Weapons Center, performed a biological resource study of Mountain Springs Canyon. The purpose of the study was to gain an inventory of vegetation and wildlife resources of the canyon in order to enlarge and update the general biological data base for the Naval Weapons Center as well as to gain specific information about Mountain Springs Canyon for future resource management considerations.

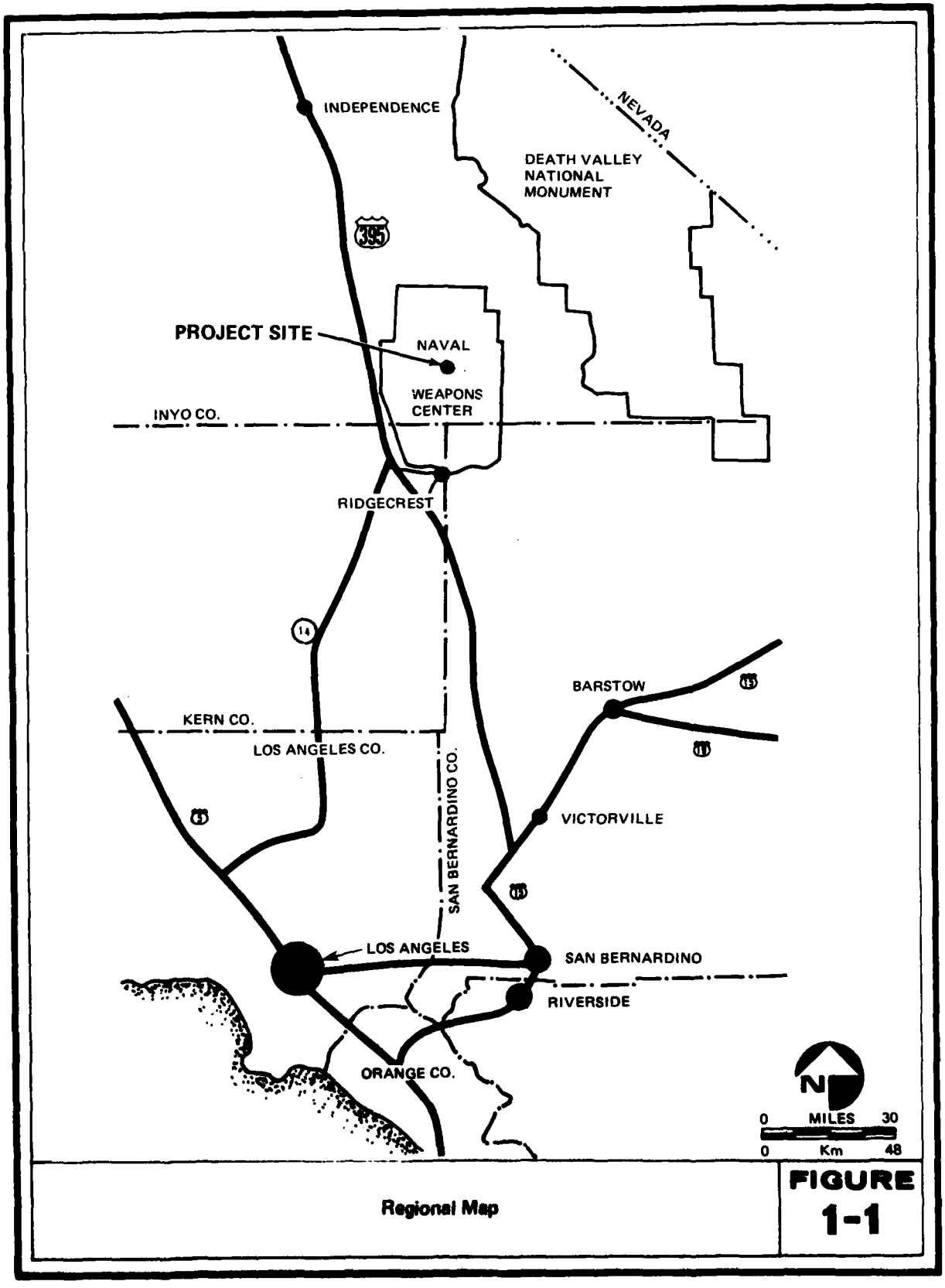
The specific study scope included intensive vegetation and wildlife surveys of the entire study area. Vegetation surveys included detailed vegetation mapping, compilation of an extensive list of annual and perennial species, quantitative assessment of each plant community, and directed searches for sensitive species. Wildlife studies included quantitative and qualitative inventories of birds, qualitative and quantitative mammal inventories, and qualitative reptile and amphibian inventories. In addition to these studies, areas of biological sensitivity and measures to manage the biological resources of Mountain Springs Canyon were also identified.

## 1.2 STUDY LOCATION

Figure 1-1 illustrates the regional location of China Lake Naval Weapons Center within the northwestern Mojave Desert. Figure 1-2 delineates the location of Mountain Springs Canyon within the Argus Mountains. The study area consisted of approximately 8500 acres in Sections 7 through 18 of T23S, R41E and portions of Section 7, 8, 17 and 18 of T23S, R42E (Mountain Springs and Trona 15-minute USGS topographical maps). The canyon generally trends from west to east with elevations of 1097 m (3600 ft) at the canyon mouth to 1768 m (5800 ft) at the easterly end of the canyon. The canyon contains a number of distinct vegetative associations due to the sharp elevational east-west gradient as well as the steep south and north-facing slopes of the respective side walls.

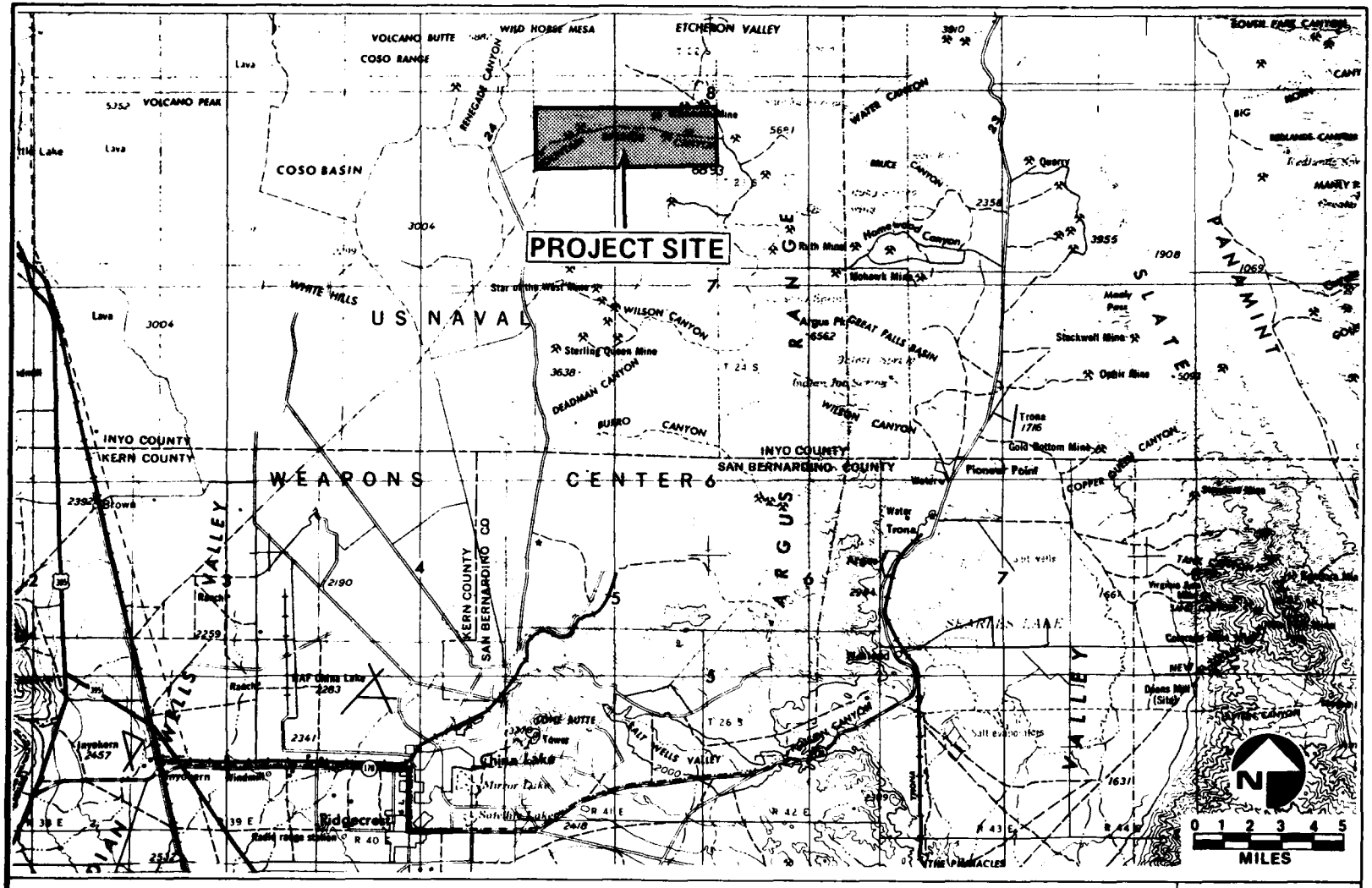
## 1.3 STUDY LIMITATIONS

The study was conducted during the month of May 1982. Because of the lateness of the spring this year the surveys were delayed until this time in order to conduct the botanical inventory during the time when the maximum amount of vegetation was in a phenological state to allow adequate identification. Wildlife surveys were representative or reflective of springtime conditions.




Regional Map

**FIGURE 1-1**




Vicinity Map Showing Location of Study Area.

**FIGURE 1-2**

It should be noted that this survey should be considered a one-point-in-time survey. Seasonal trends or multiyear trends cannot be determined.

## 1.4 PERTINENT LITERATURE

A variety of biologically-oriented studies have been conducted within the confines of the Naval Weapons Center (Ouimette, 1974; Phillips Brandt Reddick, 1981; WESTEC Services, 1979; Zembal et al., 1979). Studies are also present which have dealt specifically with Mountain Springs Canyon (Beckingham et al., 1981; Cord and Jehl, 1979). Mary Ann Henry has conducted a long-term comprehensive examination of the flora of Mountain Springs Canyon (in Beckingham et al, 1981); whereas Cord and Jehl (1979) concentrated on the occurrence of the state-listed endangered Inyo Brown Towhee (Pipilo fuscus eremophilus).

A study currently underway to examine the biota of several springs in the general vicinity of Mountain Springs Canyon by Phillips Brandt Reddick may yield valuable comparative data to the results of this study effort.

# SECTION 2
# METHODS

## 2.1 VEGETATION

### 2.1.1 General Surveys - Vegetative Mapping/Species Inventory

Plant inventories were initially obtained by general qualitative surveys during the period May 3-10, 1982. Plant communities and associations were determined and mapped through a general foot survey of the study area. Species lists were compiled in each vegetative type. Attention was given to the delineation of ecotonal areas and other areas of significant vegetation change. Evidence of burro impacts on vegetation was also noted.

Representative areas in different habitat types in Mountain Springs Canyon and adjacent areas at the upper and lower canyon mouths were selected for detailed study based on the initial general reconnaissance. An extensive plant collection was made in each of the representative areas. Collected plants were pressed and identified in the field or later in the laboratory. Voucher specimens will be submitted to the herbarium at the University of Nevada, Las Vegas. Scientific nomenclature for plants throughout this report follows Munz (1974). Common names for the most part follow Jaeger (1969).

### 2.1.2 Quantitative Analysis

Quantitative procedures were employed by beltline transects (Mueller-Dombois and Ellenberg, 1974) in representative areas of Mountain Springs Canyon. Five major transects studied were completed in the study area as delineated in Figure 3-1. Transect sites were selected to include all the major vegetative associations which reflects the influence of the elevational gradient in the canyon. Similarly, sites were selected in conjunction with the wildlife study plots in order to allow a comparison of interrelated biotic components.

Each transect was composed of three randomly spaced 50-m lines. A 3-m swath along both sides of each line was used to determine shrub density and frequency of occurrence. The height of each perennial was recorded within a 1-m swath along one side of each line using a meter rule. Shrub cover was obtained by measuring the diameter of every shrub within the same 1-m swath. Shrub cover was converted to the area of a circle by the formula:

$$d^2 \times 0.785 = \text{surface area in } m^2$$

where d = the diameter of shrub at its maximum

The summed values for each 3-line transect were calculated for percent cover, frequency of occurrence, and density of each plant species encountered. These mean values were then used to calculate relative cover, relative frequency, and relative density as a percentage of all species for each transect. The sum of the three relative values was termed as importance value, and was used to assess the contribution of each plant species to the community structure. The assessment of importance value follows Curtis (1959) and was calculated by the following formula:

$$\frac{\text{species cover}}{\text{total cover}} + \frac{\text{species frequency}}{\text{total frequency}} + \frac{\text{species density}}{\text{total density}} = \text{importance value}$$

The importance value will have a maximum value of 300, depending on the dominance of a given species.

Species diversity (H') was calculated for each transect site from the equation of Shannon and Weaver (1963). Species evenness (V') for each transect site was calculated from the equation of Hurlbert (1971). Species richness (S*) was indicated for each transect site as the total number of perennial species present.

Annual plant species were assessed on 1-$m^2$ plots at every 10 m along each line. The density of each annual species for all the plots in each line was noted and summed. The percentage of ground cover composition was also recorded for each plot. The percentage rock component of ground cover indicates particles 2 cm in diameter and greater, small rock 0.2 to 2 cm in diameter, and bare ground less than 0.2 cm. The litter category was assigned to all organic matter on the surface of the ground including shrub trunks.

The species density and composition of the patches of riparian habitat in the drainages of the canyon were analyzed by estimating the number of individuals and the percent cover of each perennial species in each patch. The riparian areas that were examined included only those patches found along the central drainage of the canyon, running roughly parallel with the main road. Riparian patches found in smaller tributary side canyons were surveyed and mapped, but were not included in the above analysis.

### 2.1.3 Rare Plant Surveys

Prior to conducting field surveys, WESTEC biologists prepared a list of rare, threatened, or endangered plant species that could occur within the study area. Known distribution of each species was checked on California Native Plant Society inventory maps (Smith et al., 1980). Directed searches in potential habitat for each species were conducted.

## 2.2 AVIAN SURVEYS

### 2.2.1 Censusing Techniques

Bird populations were censused with one of two techniques. The Emlen variable strip transect method (Emlen, 1971; 1977) was used for the two upland study sites whereas a modified strip/belt transect method was adopted for the riparian study areas. Emlen's method was considered inappropriate for the riparian habitats for several reasons: small absolute area, narrowness of habitat, and patchiness of vegetation. One of the key underlying assumptions of the Emlen method is that the area censused is as homogeneous as possible with respect to its vegetative structure.

The two upland and three riparian sites examined are located on Figure 2-1. Names of the riparian study sites follow those used by Beckingham et al. (1981). Each sampling area was censused for three consecutive days in the mornings. Censuses were conducted within the first 3 hours of sunrise and each lasted approximately 1.5 hours. Emlen transects optimally should be 1 mile in length, but the lack of uniform habitat forced the shortening of the second upland transect to 1 km. Both upland transects were 126 m on either side of the centerline. The length and width of the transects in the riparian habitats included the entire habitat area. Along each transect, bird species were noted with respect to numbers, sex, age, behavior, and location. Emphasis was put on identifying any evidence of breeding activity such as vocalizations, carrying of nest material, the presence of a nest, etc.

### 2.2.2 Raptor Survey

The Mountain Springs Canyon area was surveyed for raptors by car and on foot in the afternoons for approximately 5 hours per day for 7 consecutive days. Potential raptor nesting areas were carefully examined for signs of nesting activity.

### 2.2.3 Inyo Brown Towhee Survey

Riparian areas were assessed with respect to their suitability for the Inyo Brown Towhee, a species listed as endangered by the California Fish and Game Commission (1980). An initial assessment of all riparian areas in the canyon proper was conducted to categorize areas relative to described habitat requirements for the taxa

(Cord and Jehl, 1979). The three largest riparian areas (Figure 2-1) were censused for the presence of the Inyo Brown Towhee for three consecutive mornings. All other smaller riparian areas were surveyed for the species in the afternoons and early evenings (see Figure 3-1). Time constraints precluded analysis of small riparian patches within side canyons.

### 2.2.4 Sensitive Habitats

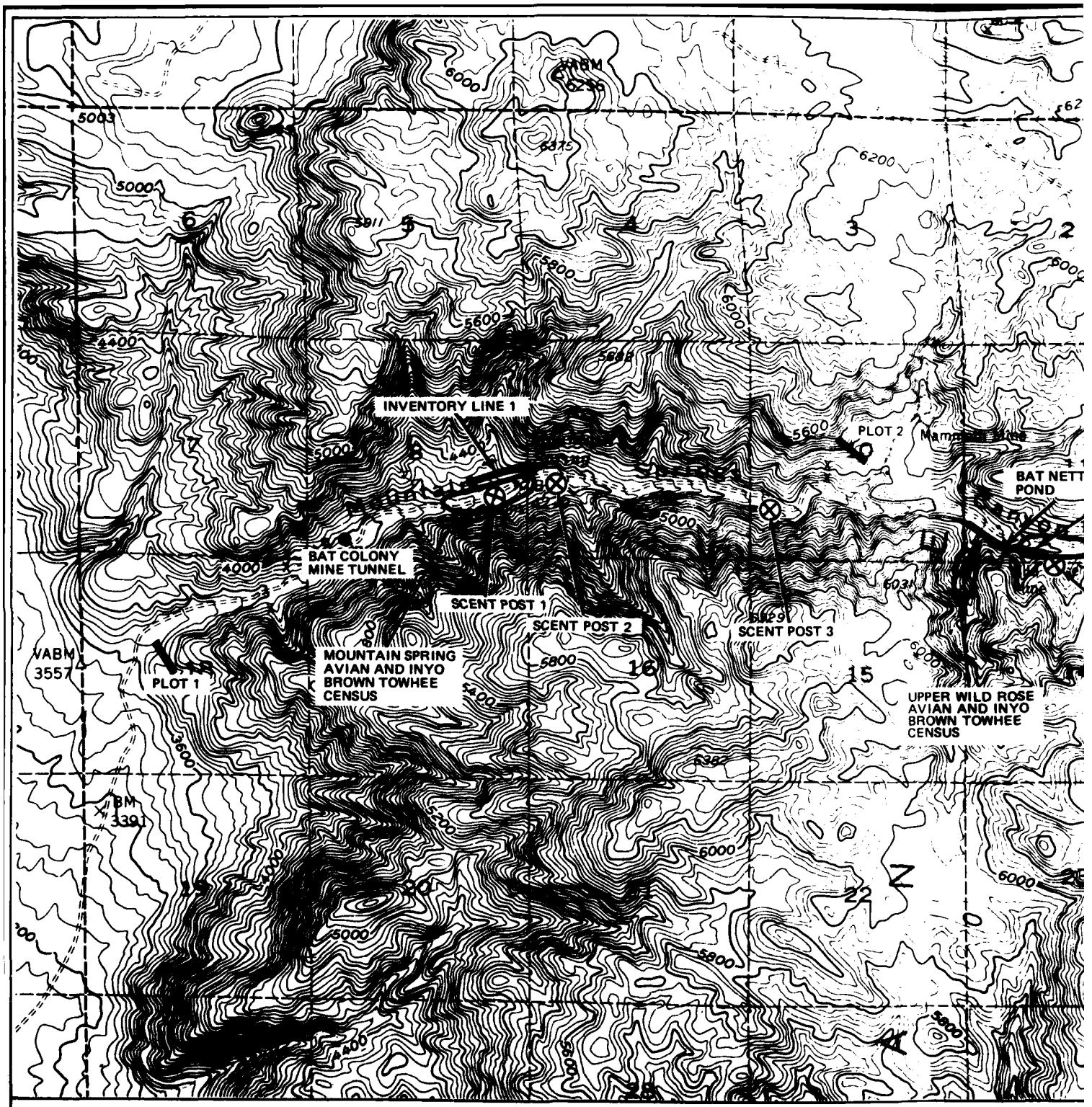
The Mountain Springs Canyon area was also surveyed with respect to unique and/or sensitive habitats which are important to avian wildlife. These included springs, pools, riparian areas and vegetation islands.

## 2.3 MAMMAL SURVEYS

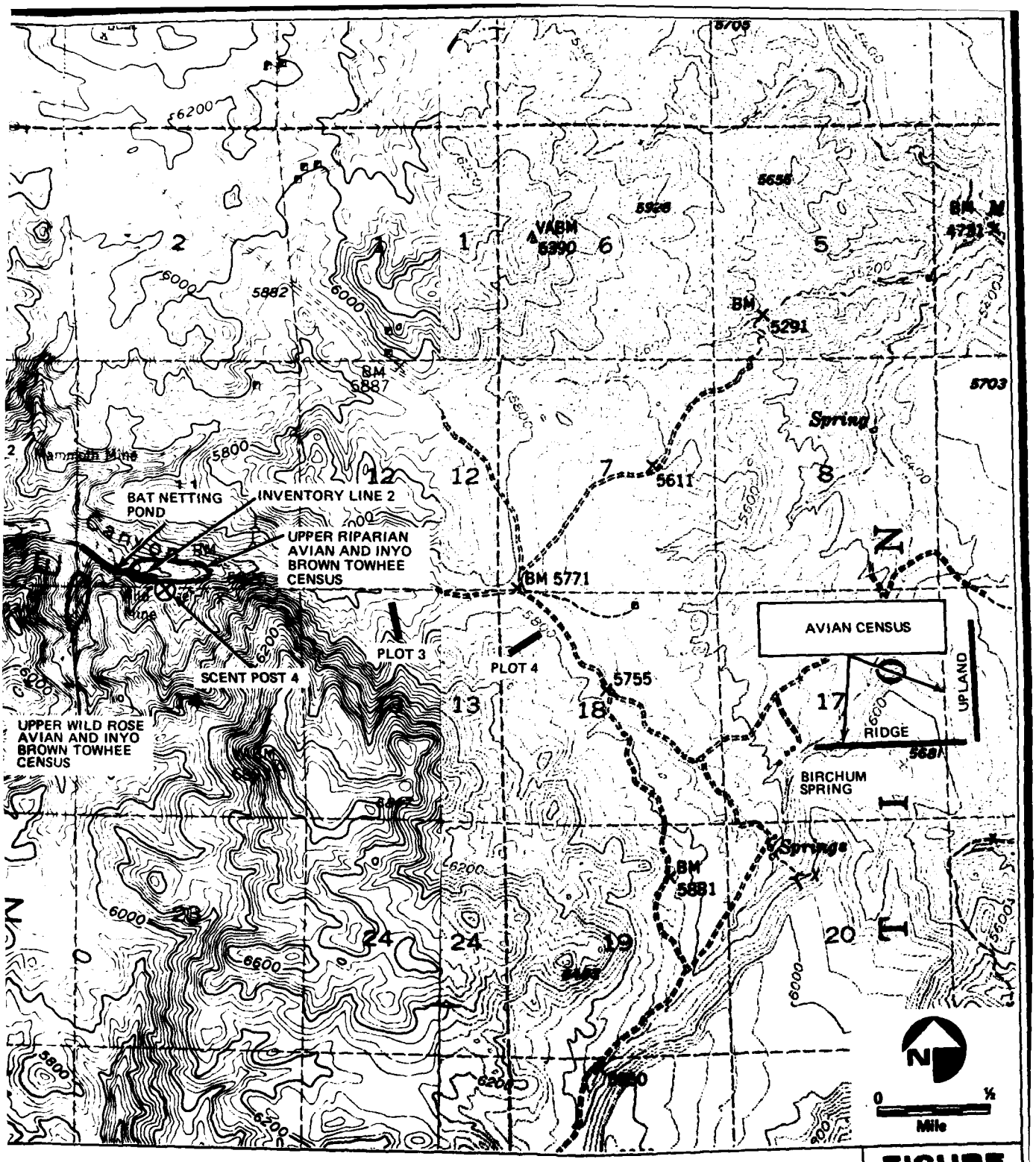
### 2.3.1 Small Mammal Surveys

Mountain Springs Canyon was examined for variations in plant community types and four conventional trapping plots were established in representative habitats where feasible (Figure 2-1). In order to obtain the best unbiased estimate of rodent density it is important to select relatively homogeneous habitats, and the physical size of the trapping plot must be a certain minimum. Therefore, some habitats which were very small patches were not sampled conventionally. The riparian and desert wash habitats represented linear, narrow patches which were best sampled by linear inventory trap lines. The selective use of both trapping methods allowed adequate sampling of all major habitat types within Mountain Springs Canyon.

The four conventional trapping plots utilized parallel line-assessment line configurations following the methodology of O'Farrell et al. (1977). Parallel lines were 20 stations in length and 53 m between lines. Four assessment lines were placed intersecting the parallel lines at stations 1 and 10 and oriented at a 45° angle from the parallel lines. Assessment lines were 18 stations long, with the intersection point at Station 16, and 15 stations outside and 2 stations inside the parallel lines. All trap stations were placed at 15 m intervals. Briefly, the rationale for this method is that the precise area actually being sampled by the basic configuration can be determined from the movements of basic configuration-marked animals along the assessment lines. The proportion of basic configuration-marked animals to assessment line only animals within the area of effect is obtained from assessment-line trapping and the number of basic configuration animals is then adjusted using this proportion. True density can then be calculated from the adjusted number and actual area of effect.




**Locations of Mammal Survey Sites (Plot x, Inventory x, Pond, Avian and Inyo Brown Towhee Census Sites.**




x, Inventory x, Pond, Mine Tunnel, Scent Post x) and
ites.

**FIGURE 2-1**

Trapping on the parallel lines occurred from May 4 through 7, 1982. Traps were then moved to assessment lines and trapping conducted from May 8 through 9, 1982. Traps were checked in the morning and afternoon. Upon capture, an animal was identified to species and sex, assessed for reproductive conditions, toe-clipped for future identification, weighed to the nearest 0.1 g with a Pesola scale, and released at point of capture.

Inventory lines consisted of a linear configuration of 40 stations at approximately 15 m intervals. Line 1 was placed in the riparian habitat supported by Mountain Spring and Line 2 was placed in the narrow wash habitat by Wild Rose Mine which was dominated by thick Mojave Rabbitbrush (Chrysothamnus nauseous) (Figure 2-1). Trapping on these lines was conducted from May 6 through 9, 1982. Traps were checked both in the morning and late afternoon.

The bat fauna was assessed by exploration of the major mine complex at the western end of the canyon and by mist-netting the pond below the Wild Rose Mine (Figure 2-1). The WESTEC Ultrasonic bat monitor was also used to locate non-observable, foraging bats. The bat monitor receives raw sonar bat pulses, amplifies the incoming signal, electronically divides the frequency information to reduce the ultrasound to human audible range, and then further amplifies the signal for auditory output. Variations in frequency width, pulse length, and harmonic component allows the accurate identification of bat species by differences in tonal qualities.

### 2.3.2 Large Mammal Surveys

Several methods were used to inventory the large mammal component. Four scent posts were placed strategically at riparian patches within the canyon (Figure 2-1), to sample the most likely spots for carnivores. Due to the topography and substrate within the canyon and the patchiness of riparian habitat, scent posts were placed approximately at 1 mile intervals. Each scent post consisted of a roughly 1-m circular patch, cleared and covered with fire clay and a plastic capsule filled with scent placed in the center (Roughton, 1974; Roughton and Sweeney, 1982). Scent posts were operative from May 6 through 9, 1982. They were checked in the morning and afternoon each day; all tracks were identified with the aid of Murie (1975), photographed, and then the area was brushed smooth after each check.

Spotlight transects were conducted by driving through the canyon at night in order to spot eyeshine of large mammals. Rock outcrops were searched for signs of denning activity and scats, and in addition tracks, scats and burrows were searched for throughout our daily survey activities.

## 2.4 AMPHIBIAN AND REPTILE SURVEYS

Herpetiles were sought throughout the canyon area in the course of all daily and nightly activities. Water bodies were examined for amphibians. Roadways were examined during spotlight transects. Upon sighting, individuals were identified to species, assigned relative age and enumerated to obtain relative abundance estimates.

# SECTION 3
# RESULTS

## 3.1 VEGETATION

### 3.1.1 Plant Communities and Species Occurrence

Seven vegetative habitats were observed in the study area, as shown on Figure 3-1. These plant habitats include the Creosote Bush scrub, Grayia-Lycium (Spiny Hopsage-Peach-Thorn), Artemisia-Coleogyne (Big Sagebrush-Blackbrush), Haplopappus-Coleogyne (Goldenbush-Blackbrush), desert wash, riparian woodland, and Pinyon Pine woodland. Mountain Springs Canyon is an east-west trending canyon characterized by steep north-and south-facing slopes on either side. The aspect of these slopes is a major factor in the delineation of the various plant associations. A listing of the plant species observed in Mountain Springs Canyon by habitat is included in the Appendix, Table A-1. The quantitative results of the plant transects and riparian habitat analysis are shown in Table 3-1 and in Tables A-2 through A-7 in the Appendix.

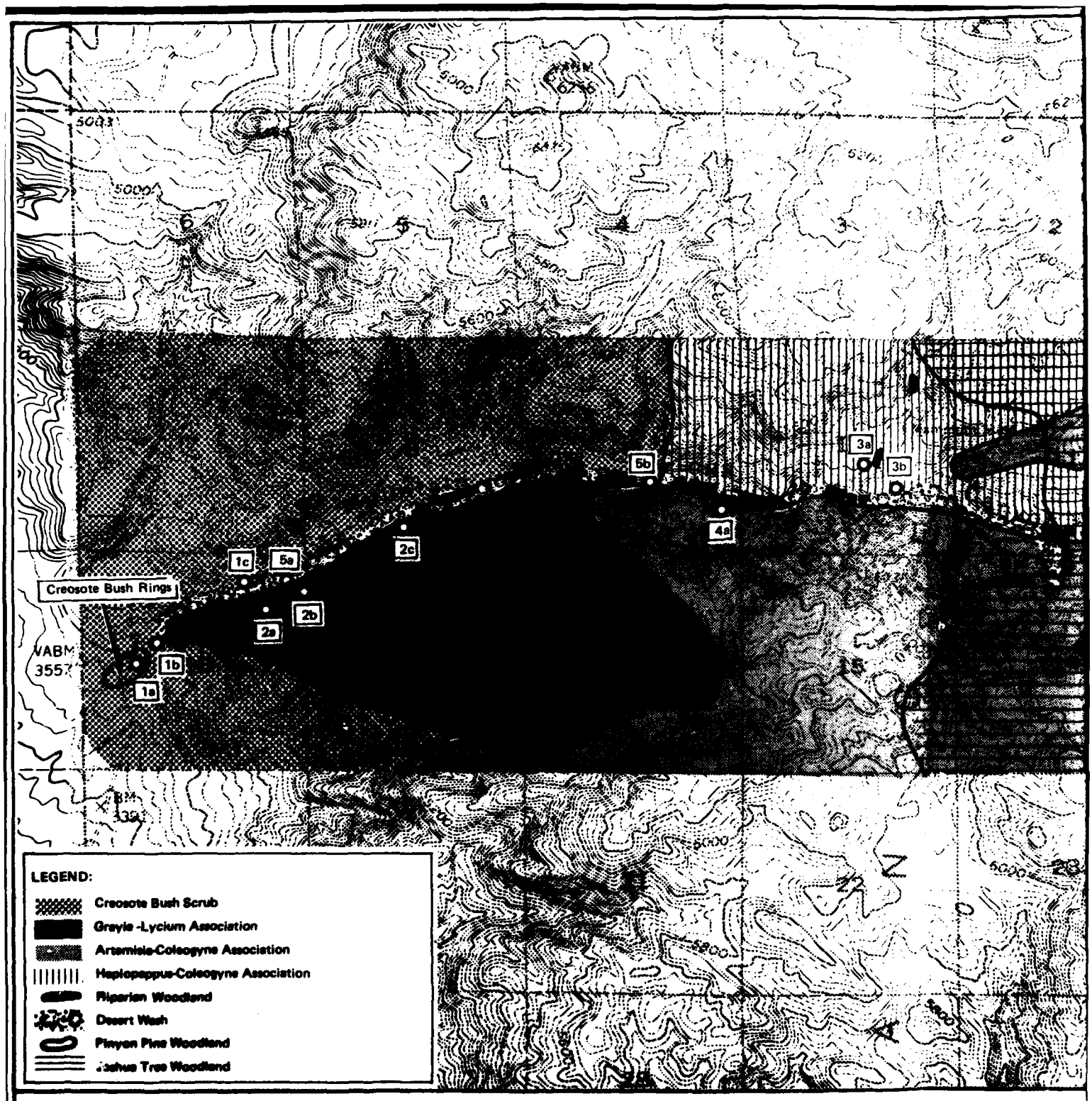
The Creosote Bush scrub community (Thorne, 1976; Vasek and Barbour, 1977) was found in the lower canyon on the steep south-facing slope below 1585 m (5200 feet) elevation and on the bajada west of the canyon mouth. This community had by far the lowest species richness, evenness, and diversity of the five major habitat types examined (Table 3-1). The community was clearly dominated by two species: Creosote Bush (Larrea tridentata) with an importance value of 107.18 and Burrobush (Ambrosia dumosa) with an importance value of 107.27 (Table A-2). The next highest importance value of 15.50 was shown by Beavertail Cactus (Opuntia basilaris), a small cactus with only three individuals appearing in the transect. A total of eight other perennial species were observed in the transect for this plant community, but all had a much lower density and importance value. On the bajada transect line, in and near a major wash, several small Creosote Bush rings (less than 2 m in diameter) were observed. Annual vegetation was dominated (at least in terms of density) by three introduced, ubiquitous species: Arabian Schismus (Schismus arabicus -- 2776 individuals per 15 $m^2$), Filaree (Erodium cicutarium -- 196 individuals per 15 $m^2$), and Foxtail Chess (Bromus rubens -- 112 individuals per 15 $m^2$). The most common native annual species included Brittle Chorizanthe (Chorizanthe brevicornu -- 97 individuals per 15 $m^2$), Broad-flowered Pincushion (Chaenactis stevioides -- 67 individuals per 15 $m^2$), and Broad-toothed Combbur (Pectocarya platycarpa -- 58 individuals per 15 $m^2$). A total of 30 annual species were observed in the transect.

Table 3-1

PERENNIAL AND ANNUAL SPECIES RICHNESS
(# OF SPECIES), AND PERENNIAL SHRUB DIVERSITY
(H') AND EVENNESS (V')
FROM VEGETATIVE TRANSECTS IN MOUNTAIN SPRINGS CANYON[1]

| Transect # | Plant Association | Species Richness | | | | |
|---|---|---|---|---|---|---|
| | | Annuals | Perennials | Total | H' | V' |
| 1 | Creosote Bush Scrub | 30 | 11 | 41 | 0.38 | 0.37 |
| 2 | Grayia-Lycium | 20 | 29 | 49 | 1.15 | 0.79 |
| 3 | Artemisia-Coleogyne | 25 | 14 | 39 | 0.59 | 0.52 |
| 4 | Haplopappus-Coleogyne | 32 | 14 | 46 | 0.80 | 0.70 |
| 5 | Desert Wash | 12 | 19 | 31 | 0.79 | 0.62 |

[1]See Figure 3-1 for transect locations.




Vegetative Cover and Locations of Plant Transects

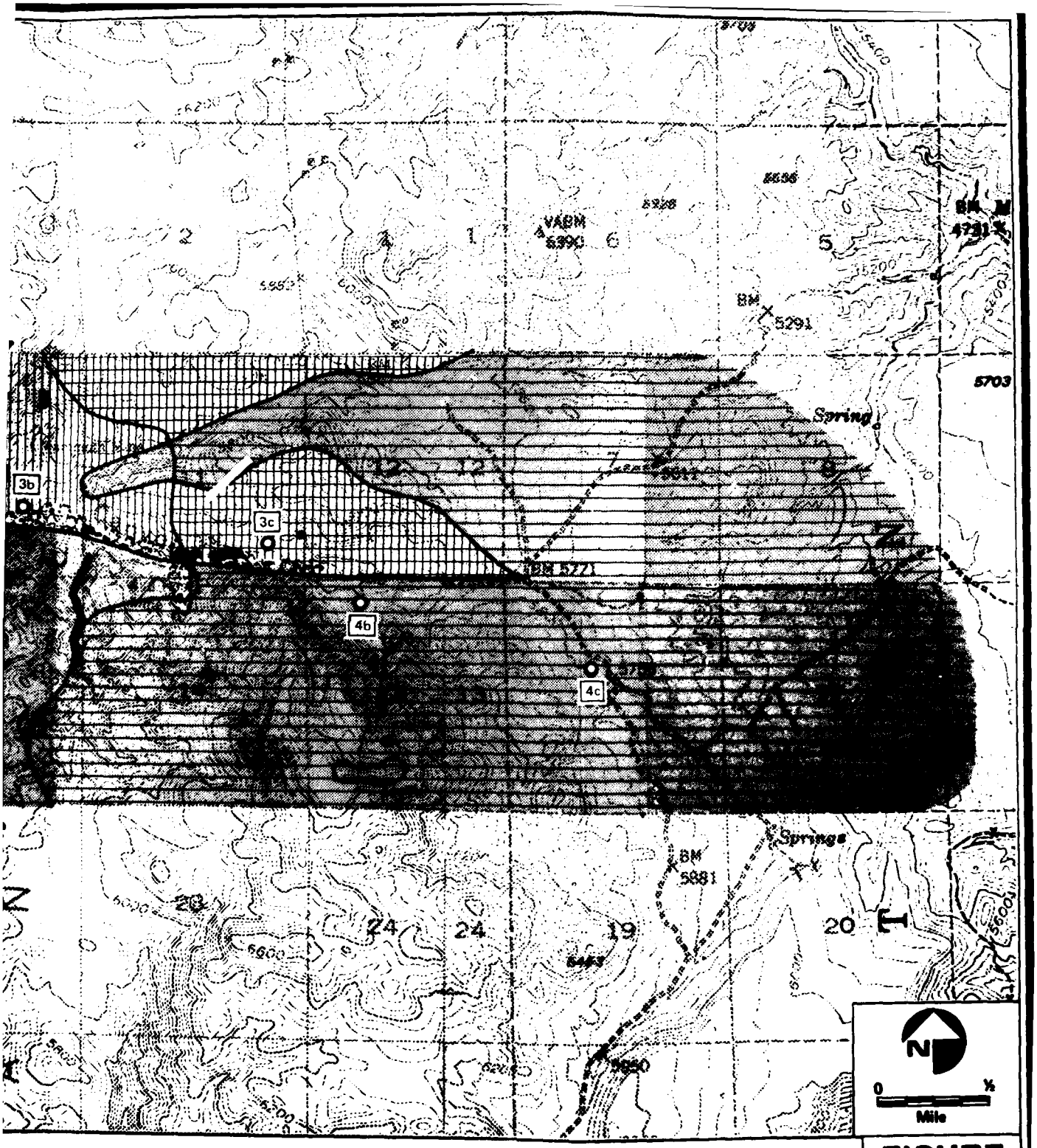



**FIGURE 3-1**

**tions of Plant Transects (1x)**

The Grayia-Lycium association (Beatley, 1976) represented by Transect 2 (Table 3-1) was found on the steep north-facing slope of the canyon between 1158 m (3800 feet) and 1768 m (5800 feet) elevation in the lower 5 km of the canyon. The substrate consisted of a high percentage of rock (55.27 percent). This community had by far the highest perennial species richness (29 species), diversity (1.15) and evenness (0.79) values of any of the plant communities sampled (Table 3-1). Of the 29 perennial species observed, 13 species had an importance value within the range of 10.06 to 23.07. Spiny Hopsage (Grayia spinosa) had the highest importance value of 55.57, and the combined Lycium (Anderson Thornbush and Peach-Thorn) importance value was 26.21. Bromus rubens clearly dominated the annual understory.

The Grayia-Lycium association gave way abruptly to the Artemisia-Coleogyne association (Beatley, 1976) further up the canyon where the aspect of the north-facing slope changes from northwest to north near Mountain Spring (Figure 3-1). Big Sagebrush (Artemisia tridentata) had the highest importance value of 83.83 in this community followed by Blackbrush (Coleogyne ramosissima) (56.69), Antelope-Brush (Purshia glandulosa) (32.46), and California Buckwheat (Eriogonum fasciculatum) (27.02) (Table A-4). The most common annual species included Broad-leaved Gilia (Gilia latiflora) (298 individuals per 15 $m^2$), Granite Collinsia (Collinsia callosa) (108 individuals per 15 $m^2$), and Golden Linanthus (Linanthus aureus) (99 individuals per 15 $m^2$). The sandy soil characteristic of this area was reflected by the low rock (0.87%) and small rock (29.60%) ground cover, and the high percentage of bare ground (58.60%). Species richness (14 perennials), diversity (0.59) and evenness (0.52) were lower for this community than for any other habitat with the exception of Creosote Bush scrub (Table 3-1). This vegetative type is found up the canyon on the north-facing slope and covers the top of the study area.

A phase of Blackbrush (Coleogyne) (Beatley, 1976) was found on the south-facing slope generally opposite the Artemisia-Coleogyne community between 1524 m (5000 feet) and 1829 m (6000 feet) elevation, designated as the subset association Haplopappus-Coleogyne in the present study. This association had no one dominant species. It was occupied primarily by the following perennials: Goldenbush (Haplopappus laricifolius) (importance value of 57.57), Desert Rock-Pea (Lotus rigidus) (48.72), Coleogyne ramosissima (38.89), Eriogonum fasciculatum (37.81), Linear-leaved Goldenbush (Haplopappus linearifolius) (35.53), and Bladder Sage (Salazaria mexicana) (24.28) (Table A-5). The most common annuals were Bromus rubens, Cheat Grass (Bromus tectorum) and Pinyon Gilia (Gilia ophthalmoides) (Table A-5). Although perennial species richness was

the same as for Transect 3 (14 species), the evenness value of 0.80 is substantially higher, reflecting a more even distribution and dominance of the community by several species.

The desert wash habitat was represented by Transect 5 (Table A-6). The dominant species in the wash habitat was Cattle Spinach (Atriplex polycarpa) (importance value 129.68). Codominants include Mojave Rabbitbrush (Chrysothamnus nauseosus) (41.43), Sand-Wash Groundsel (Senecio douglasii) (21.40), and Cheese-Bush (Hymenoclea salsola) (18.69). It should be noted that Chrysothamnus formed almost pure stands in the upper wash, but was absent from the lower wash areas; this demarcation coincided with the major changes in plant communities in mid-canyon. The wash habitat of lower elevations was dominated by Atriplex polycarpa. The other species listed were primarily marginal species which interface between the wash and other adjacent habitats. Perennial species richness in the wash is 19 species, diversity 0.79, and evenness 0.62 (Table 3-1). With the exception of Schismus arabicus (1700 individuals per 10 $m^2$) and Bromus rubens (565 individuals per 10 $m^2$), annual species density was quite low. Likewise, annual species richness was also low.

Intermixed with patches of wash vegetation in the canyon were patches of riparian woodland (Thorne, 1976). Arroyo Willow (Salix lasiolepis) was the dominant species in the riparian areas, with a total of 107 individuals found in 13 of the 15 patches observed, and a total estimated coverage of 54.20 percent (Table A-7). Yellow Willow (Salix lasiandra) was found in 10 patches, 112 individuals were observed, and the total percent cover was 31.67 percent. Sixty-four individuals of Desert-Olive (Forestiera neomexicana) were observed in five patches, with a total coverage of 13.47 percent. The areal extent of riparian vegetation excluding the upper reaches of the tributary drainages, is estimated at 13.5 acres.

A small patch of Pinyon Pine woodland (Vasek and Thorne, 1977) was found high on the north-facing slope at 2073 m (6800 feet) elevation in the east end of the canyon (Figure 3-1). A list of species observed is presented in Table A-1. Quantitative transects were not conducted in this habitat due to its small size. At this higher elevation, the dominant shrub species were Artemisia tridentata and Buckwheat (Eriogonum umbellatum).

### 3.1.2 Distribution of Sensitive Species

Directed surveys for sensitive plant species resulted in the discovery of no listed threatened or endangered species as well as any other sensitive species.

## 3.2 AVIAN RESOURCES

### 3.2.1 Bird Populations

Sixty-five bird species (Table A-8) were observed in Mountain Springs Canyon. Although it was already the first week in May, breeding bird populations were still being established. A long and cold spring had occurred and in fact, unseasonably cold nights were experienced during the course of the present study. Migratory birds usually pass through the area in April, yet during the present study, they were observed regularly on a daily basis (Tables A-8 and 3-2). Eleven migrant species were observed on the two riparian study sites (Table 3-2) and two others, the Acorn Woodpecker and Red-breasted Nuthatch, were seen on the uplands immediately adjacent to the riparian habitats. In contrast, only four migrant species were observed on the upland sites, three of which possibly would be summer residents of riparian habitats within Mountain Springs Canyon or the surrounding area. A more elusive migrant, the Flammulated Owl (one individual) was seen in a wash leading down from an isolated, small stand of Pinyon Pine woodland on the north-facing slope at the east end of the Canyon (Figure 3-1).

There were 11 and 10 breeding bird species (Table 3-3) found on the Upper Riparian and Upper Wildrose riparian study sites, respectively. Densities were fairly even in both areas with the Lesser Goldfinch and Wilson's Warbler being most abundant. The breeding bird densities in Upper Riparian and Upper Wildrose were 872.2 pairs/40 ha and 515.2 pairs/40 ha, respectively. Two nests were found, a Lesser Goldfinch on Upper Riparian and a Bell's Vireo on Upper Wildrose. Both sites were utilized by three upland breeding bird species, the Sage Thrasher, Black-tailed Gnatcatcher and House Finch (Table A-8). Breeding bird species composition appeared similar in the Mountain Spring riparian site (Table 3-4). All species occurring at Mountain Spring were also censused on the Upper Riparian and Upper Wildrose sites. Lack of time made obtaining quantitative data for this site impossible.

There were 11 and 15 breeding bird species (Table 3-5) found on the Ridge and Upland upland study sites, respectively. In contrast with the riparian census data, densities were not evenly distributed resulting in a lower overall diversity. In terms of numbers, the Brewer's Sparrow dominated both areas. Average breeding bird densities were significantly lower than those in the riparian areas, reaching 284.6 pairs/40 ha at the Upland site and 200.1 pairs/40 ha at the Ridge study area.

### 3.2.2 Raptor Populations

No active or inactive raptor nests were found during the survey. Only two raptors, a Red-tailed Hawk and an American Kestrel, were sighted during the week-long survey.

Table 3-2

RESIDENTS OF ADJACENT HABITAT (a) AND/OR MIGRANT (m) BIRD SPECIES OBSERVED ON THE AVIAN STUDY SITES

| Upper Riparian | Upper Wildrose | Upland | Ridge |
|---|---|---|---|
| Sage Thrasher (a) | Band-tailed Pigeon (m) | Yellow-rumped Warbler (m) | Empidonax (m) |
| Black-tailed Gnatcatcher (a) | Common Bushtit (a) | | Rufous-sided Towhee (m) |
| Ruby-crowned Kinglet (m) | Sage Thrasher (a) | | Wilson's Warbler (m) |
| Warbling Vireo (m) | Blue-gray Gnatcatcher (a, m) | | |
| Townsend's Warbler (m) | Black-tailed Gnatcatcher (a) | | |
| | Solitary Vireo (m) | | |
| Western Tanager (m) | Warbling Vireo (m) | | |
| Black-headed Grosbeak (m) | Yellow-rumped Warbler (m) | | |
| House Finch (a) | Black-throated Gray Warbler (m) | | |
| White-crowned Sparrow (m) | Townsend's Warbler (m) | | |
| | Black-headed Grosbeak (m) | | |
| | House Finch (a) | | |

Table 3-3

BREEDING BIRD SPECIES DENSITIES AND DIVERSITIES IN THE RIPARIAN HABITATS FROM MAY 7 TO 9, 1982

| | Upper Riparian Density-Pairs/40 ha | Upper Wildrose Density-Pairs/40 ha |
|---|---|---|
| California Quail | 66.8 | |
| Mourning Dove | 66.8 | 22.4 |
| Costa's Hummingbird | 66.8 | 67.2 |
| Ash-throated Flycatcher | 66.8 | |
| Empidonax sp. | | 22.4 |
| Bewick's Wren | 66.8 | |
| Bell's Vireo | | 44.8 |
| Yellow Warbler | 66.8 | |
| Wilson's Warbler | 135.5 | 89.6 |
| Brown-headed Cowbird | | 22.4 |
| Lazuli Bunting | 66.8 | 44.8 |
| Lesser Goldfinch | 135.5 | 134.4 |
| Rufous-sided Towhee | 66.8 | 44.8 |
| Inyo Brown Towhee | 66.8 | 22.4 |
| TOTAL PAIRS/40 ha | 872.2 | 515.2 |
| HABITAT AREA (ha) | 0.59 | 1.78 |
| TOTAL NUMBER OF SPECIES (S*) | 11 | 10 |
| SPECIES DIVERSITY (H') | 1.02 | 0.92 |
| SPECIES EVENNESS (V') | 0.98 | 0.92 |

Table 3-4

BIRD SPECIES OBSERVED AT MOUNTAIN SPRING FROM MAY 7 TO 9, 1982

| | |
|---|---|
| California Quail | b |
| Mourning Dove | b |
| Costa's Hummingbird | b |
| Acorn Woodpecker | m |
| Ash-throated Flycatcher | b |
| Empidonax sp. | b |
| Bewick's Wren | b |
| Blue-gray Gnatcatcher | a/m |
| Ruby-crowned Kinglet | m |
| Bell's Vireo | b |
| Warbling Vireo | m |
| Yellow Warbler | b |
| Townsend's Warbler | m |
| MacGillivray's Warbler | m |
| Wilson's Warbler | b |
| Brown-headed Cowbird | b |
| Western Tanager | m |
| Black-headed Grosbeak | m |
| Lazuli Bunting | b |
| House Finch | a |
| Lesser Goldfinch | b |
| Inyo Brown Towhee | b |
| Black-throated Sparrow | a |

b = breeder

m = migrant

a = adjacent

Table 3-5

BREEDING BIRD SPECIES DENSITIES AND DIVERSITIES IN THE UPLAND HABITATS FROM MAY 4 TO 6, 1982

| | Upland Density-Pairs/40 ha | Ridge Density-Pairs/40 ha |
|---|---|---|
| Mourning Dove | 1.9 | 1.8 |
| Costa's Hummingbird | 27.5 | 1.8 |
| Western Kingbird | 0.8 | |
| Horned Lark | 27.5 | 0.9 |
| Common Raven | 0.6 | 0.7 |
| Rock Wren | 4.2 | 1.6 |
| Sage Thrasher | 1.4 | |
| Black-tailed Gnatcatcher | 3.3 | 13.2 |
| Loggerhead Shrike | 0.3 | 0.7 |
| Western Meadowlark | 0.5 | 2.3 |
| Scott's Oriole | 1.5 | |
| House Finch | 30.3 | |
| Black-throated Sparrow | 3.3 | 66.8 |
| Sage Sparrow | 2.3 | 4.5 |
| Brewer's Sparrow | 181.0 | 105.8 |
| AVERAGE PAIRS/40 ha | 286.4 | 200.1 |
| TOTAL NUMBER OF SPECIES (S*) | 15 | 11 |
| SPECIES DIVERSITY (H') | 0.59 | 0.54 |
| SPECIES EVENNESS (V') | 0.50 | 0.52 |

### 3.2.3 Inyo Brown Towhee

A pair of Inyo Brown Towhees were observed on each of the three riparian areas intensively studied (Figure 2-1). Individuals were seen in pairs on at least 2 of the 3 days at each site. An Inyo Brown Towhee was also heard at the pond at Lower Wildrose. Inyo Brown Towhees were not observed at other less intensively sampled riparian areas.

## 3.3 MAMMAL SURVEYS

### 3.3.1 Small Mammal Trapping Results

Thirteen species of small mammals were captured through the course of live-trapping (Table 3-6). Large numbers of individuals were not captured on any site and sex ratios were skewed primarily in favor of males. Several factors should account for this and will be dealt with in detail in the discussion.

Each study plot sampled a different plant association and represented not only a change in elevation but differences in substrate and microenvironment structure. The composition of the small mammal communities at each site reflect these differences (Tables 3-7 and 3-8). Certain species, particularly the Little Pocket Mouse (Perognathus longimembris), exhibit generalist tendencies and are able to occupy a variety of habitats. Both the Long-tailed Pocket Mouse (Perognathus formosus) and the Great Basin Pocket Mouse (Perognathus parvus) occur on brush covered rocky hillsides; however, Perognathus formosus occurs at lower elevations, mainly within the Creosote Bush scrub community, whereas Perognathus parvus occupies higher elevations in various subsets of the Coleogyne associations. Merriam's Kangaroo Rat (Dipodomys merriami) occurred only in the Creosote Bush scrub study site while the Panamint Kangaroo Rat (Dipodomys panamintinus) occurred solely in Coleogyne dominated sites.

The Deer Mouse (Peromyscus maniculatus) usually tends to be ubiquitous in distribution but failed to appear in two of the study plots. General low density and patchy distribution at this particular time would account for this pattern. The other species of Peromyscus tend to be more specialized in habitat requirements. Both the Cactus Mouse (Peromyscus eremicus) and Canyon Mouse (Peromyscus crinitus) occupy primarily Creosote Bush habitat although the former occurs in bajada wash situations while the latter occurs on brush covered rocky hillsides. The Brush Mouse (Peromyscus boylii) and Pinyon Mouse (Peromyscus truei) occurred solely in Blackbrush habitat in dense shrub and rocky situations. The latter species is often found within the pinyon-juniper belt.

Table 3-6

TOTAL OF INDIVIDUAL SMALL MAMMALS CAPTURED PER STUDY SITE

Number of males and females, respectively, is shown in parentheses.[1]

| SPECIES | PLOT 1 | PLOT 2 | PLOT 3 | PLOT 4 |
|---|---|---|---|---|
| Perognathus longimembris | 1 (0, 1) | | 8 (6, 2) | 17 (15, 2) |
| Perognathus formosus | 3 (0, 3) | 3 (0, 3) | | |
| Perognathus parvus | | | 1 (1, 0) | 1 (1, 0) |
| Dipodomys merriami | 6 (3, 3) | | | |
| Dipodomys panamintinus | | | 3 (1, 2) | 1 (1, 0) |
| Peromyscus eremicus | 1 (0, 1) | | | |
| Peromyscus crinitus | | 1 (0, 1) | | |
| Peromyscus maniculatus | 1 (1, 0) | | 1 (1, 0) | |
| Peromyscus boylii | | | 1 (1, 0) | 4 (4, 0) |
| Peromyscus truei | | | 2 (2, 0) | |
| Onychomys torridus | 1 (1, 0) | | | |
| Neotoma fuscipes | | 1 (0, 1) | | |
| Ammospermophilus leucurus | | 1 (1, 0) | | |

[1]See Figure 2-1 for study plot locations.

Table 3-7

RODENT DENSITY (#/HA), SPECIES RICHNESS
AND DENSITY BASED SPECIES DIVERSITY
AND EVENNESS FOR FOUR SITES IN MOUNTAIN SPRINGS CANYON[1]

| Species | PLOT 1 | PLOT 2 | PLOT 3 | PLOT 4 |
|---|---|---|---|---|
| Perognathus longimembris | 0.55 | | 6.48 | 3.61 |
| Perognathus formosus | 1.66 | 3.24 | | |
| Perognathus parvus | | | 1.39 | 0.55 |
| Dipodomys merriami | 2.16 | | | |
| Dipodomys panamintinus | | | 0.66 | 0.55 |
| Peromyscus eremicus | 1.08 | | | |
| Peromyscus crinitus | | 1.08 | | |
| Peromyscus maniculatus | 0.55 | | 0.20 | |
| Peromyscus boylii | | | 1.39 | 2.61 |
| Peromyscus truei | | | 2.78 | |
| Onychomys torridus | 0.55 | | | |
| Neotoma fuscipes | | 1.39 | | |
| Ammospermophilus leucurus | | 1.08 | | |
| TOTAL | 6.55 | 6.79 | 12.90 | 7.32 |
| Species Diversity (H') | 0.71 | 0.55 | 0.60 | 0.48 |
| Species Evenness (V') | 0.91 | 0.91 | 0.77 | 0.80 |
| Species Richness (S*) | 6 | 4 | 6 | 4 |

[1]See Figure 2-1 for location of study sites.

Table 3-8

RODENT BIOMASS (G/HA), SPECIES RICHNESS AND BIOMASS BASED SPECIES DIVERSITY AND EVENNESS FOR FOUR SITES IN MOUNTAIN SPRINGS CANYON[1]

| Species | PLOT 1 | PLOT 2 | PLOT 3 | PLOT 4 |
|---|---|---|---|---|
| Perognathus longimembris | 4.1 | | 54.2 | 31.0 |
| Perognathus formosus | 34.9 | 69.1 | | |
| Perognathus parvus | | | 28.9 | 11.5 |
| Dipodomys merriami | 91.0 | | | |
| Dipodomys panamintinus | | | 53.4 | 41.0 |
| Peromyscus eremicus | 22.9 | | | |
| Peromyscus crinitus | | 18.0 | | |
| Peromyscus maniculatus | 9.0 | | 2.9 | |
| Peromyscus boylii | | | 19.0 | 51.8 |
| Peromyscus truei | | | 73.5 | |
| Onychomys torridus | 10.1 | | | |
| Neotoma fuscipes | | 275.2 | | |
| Ammospermophilus leucurus | | 124.2 | | |
| TOTAL | 172.0 | 486.5 | 231.9 | 135.3 |
| Species Diversity (H') | 0.58 | 0.46 | 0.68 | 0.56 |
| Species Evenness (V') | 0.75 | 0.76 | 0.87 | 0.93 |
| Species Richness (S*) | 6 | 4 | 6 | 4 |

[1]See Figure 2-1 for location of study sites.

The Southern Grasshopper Mouse (Onychomys torridus) occurs sporadically and seemingly randomly throughout a wide variety of habitats and presumably could occur in any of the habitats sampled. The Dusky-footed Woodrat (Neotoma fuscipes) was found only within riparian habitat and seems to require not only a sufficient abundance of green vegetation but also some form of overstory habitat structure. Although White-tailed Antelope Squirrels (Ammospermophilus leucurus) were observed on each plot, the species was only captured on Plot 2; this is one species that exhibits a high degree of variation in seasonal trappability which probably accounts for the low trap success in the present study.

Several other species were known to occur on the study sites but do not appear in trapping results. California Ground Squirrels (Spermophilus beecheyi) were a common diurnal animal sighted throughout the canyon, but they were much too large to be captured in the Sherman live traps. Botta's Pocket Gopher (Thomomys bottae) were apparent on Plot 4 from signs of fresh digging but since these animals are fossorial they are not captured using the types of traps at our disposal. In addition, several Desert Woodrat (Neotoma lepida) nests were observed on the rocky hillside on Plot 2; however the nests were old and appeared to be presently unused.

Rodent densities were low for any one species on all plots (Table 3-7). Habitat structural diversity was highest in Plot 1, due to the presence of washes, and Plot 3, due to rocky ravines and rich vegetative structure. This structural diversity is mirrored by the resultant species diversity indices calculated in Table 3-7. Species evenness, which reflects the contribution of each species to the total rodent community, was high for Plots 1 and 2 but lower on 3 and 4 due to the greater proportion of Perognathus longimembris present on the latter sites.

Standing crop biomass, expressed in g/ha, is presented in Table 3-8. Values were low for all species due to low densities and in most instances from the small body sizes involved. Total biomass was highest on Plot 2 mainly due to the contribution of two relatively large rodent species, A. leucurus and N. fuscipes. Patterns of species diversity, based on biomass, were similar to those shown for density based calculations. Biomass based evenness values reflect opposite trends due to the unequal weight contributions of larger rodents on Plots 1 and 2.

The width of the area of effect, which is the perpendicular distance moved by parallel-line marked animals outwards on the assessment lines, can be used as an indicator of general movement tendencies for each species. These movement values were low for all species and for most study sites. Movements were calculated at 7.5 m

with the following exceptions: Perognathus longimembris on Plot 4, 68.9 m; Dipodomys panamintinus on Plot 3, 15.9 m; Peromyscus maniculatus on Plot 3, 37.1 m; and Peromyscus truei on Plot 3, 15.9 m.

Reproductive activity was apparent for all species captured. For Perognathus longimembris, 81 percent of all males were reproductively active whereas 40 percent of the females were in estrus and 20 percent were pregnant. All of the Perognathus formosus captured were pregnant and 50 percent of male P. parvus had scrotal testes. All individuals of both Dipodomys species were reproductively active. Likewise, all of the cricetine rodents were in various stages of reproductive activity. The lone sciurid, Ammospermophilus, demonstrated no reproductive activity.

The two riparian-wash habitat inventory lines yielded very poor results. No small mammals were captured on the line in the Mountain Spring riparian habitat. Only one Peromyscus maniculatus was captured in the wash habitat above the Wildrose Pond area. This animal was taken in thick Chrysothamnus which produced a heavy overstory.

3.3.2 Bat Surveys

On May 6, 1982, the mine tunnel complex at the lower western end of the canyon was examined for bats. Dr. Pat Brown, who originally discovered a maternity colony of Townsend's Big-eared Bat (Plecotus townsendii) in this mine 2 years ago, accompanied the WESTEC survey team. An active maternity group of approximately 100 female Plecotus townsendii was found deep in the mine and several solitary males were observed in the cooler tunnels. In addition, several California Myotis (Myotis californicus) were captured in dead-end side tunnels.

On the evening of May 6, 1982 the canyon was examined utilizing the WESTEC ultrasonic bat monitor. Several foraging Plecotus townsendii and several Myotis californicus were recorded in the vicinity of the mine but nowhere else in the canyon. The pond area at Wildrose contained a number of active bats whose flight patterns over the water could be determined with the bat monitor. On May 7, 1982 one 20 m mist net was set over the Wildrose pond. One male Western Pipistrelle (Pipistrellus hesperus), three Brazilian Free-tailed Bats (Tadarida brasiliensis) (two males, one female), seven Big Brown Bats (Eptesicus fuscus) (one male, six females), and four female Hoary Bats (Lasiurus cinereus) were captured between 2030 and 2230 h. All of these species were observed and heard foraging in the vicinity of the pond. No Plecotus or Myotis were heard with the aid of the bat monitor. By 2230 h bat activity had virtually ceased.

Inclement weather, primarily strong cold winds, prevented netting procedures during the remaining evenings of the survey period.

3.3.3 Other Mammals

Spotlight surveys along the road through Mountain Springs Canyon yielded little data. No small mammals were observed during any night drive. Five Black-tailed Jack Rabbits (Lepus californicus) were sighted during the entire study period; two along the canyon road and three along the dirt road leading to Birchum Spring. At least six cottontails (Sylvilagus) were sighted, mainly near the riparian patches in the canyon. Inasmuch as both S. audubonii and S. nuttallii are expected to occur in this area, it is impossible to identify the species by sighting only. Ear measurements (>76 mm for the former and <67 mm for the latter) are essential to positive identification of the individuals (Hall and Kelson, 1959).

At approximately 2300 h one Bobcat (Felis rufus) was observed in the wash at Mountain Spring. This individual moved slowly up the south-facing slope of the canyon and disppeared over the ridge top. This was the only mammal species recorded at the scent-post tracking stations (Scent Post 2; see Figure 2-1).

During one evening near Birchum Spring a family group of Coyote (Canis latrans) was heard vocalizing. Another group was noted vocalizing the following night near Plot 1 at the canyon mouth. No other observations of this species were made. Additionally, the presence of Kit Fox (Vulpes macrotis) was verified by finding old burrows on trapping Plot 3. No other sign of Vulpes was found and no traps were marked by this species during the course of the trapping study.

While exploring the lower mine for bats, Dr. Brown described finding scat from Ringtail (Bassariscus astutus) within the tunnel 2 weeks previous. No fresh scat was observed in the mine or within the many rock outcrops within the canyon.

During the course of trapping, a few old pellet groups of Mule Deer (Odocoileus hemionus) were observed on trapping Plot 3. No fresh scat or tracks were observed. The other ungulate that was observed was Feral Burro (Equus asinus). Three females (two pregnant) were observed in the bottom portion of the canyon. Several solitary males were observed in the middle portion and a group of five were seen near the top of the canyon. Vocalizing burros were continually heard through the course of the survey. A checklist of mammals observed in Mountain Springs Canyon is included in Table A-9.

## 3.4 AMPHIBIAN AND REPTILE SURVEY

No amphibians were found during the survey. Additionally, no vocalization was heard during nighttime surveys. A checklist of reptiles found within Mountain Springs Canyon is provided in Table A-10. Inasmuch as habitats varied greatly through the canyon, each species is best discussed by habitat type. Within the Creosote Bush habitat, the Western Whiptail (Cnemidophorus tigris) was the most common species although a few Zebra-tailed Lizards (Callisaurus draconoides) were found in the wash bottoms and a few Desert Spiny Lizards (Sceloporus magister) in rocky patches.

Within the canyon proper Cnemidophorus tigris and Sceloporus magister were the most abundant species observed; the former occurring in less rocky habitat and the latter most common among the rocks. A few Side-blotched Lizards (Uta stansburiana) were sighted in the Artemisia-Coleogyne community and in the same habitat, one Gilbert's Skink (Eumeces gilberti) (blue-tailed phase) was collected in a rock outcrop.

Snakes were most commonly found on the road in the upper half of the canyon. Road-killed individuals were as follows: one Desert Rosy Boa (Lichanura trivirgata), one Speckled Rattlesnake (Crotalus mitchelli), and two Western Patch-nosed Snakes (Salvadora hexalepis). Striped Whipsnakes (Masticophis taeniatus) were observed in Haplopappus-Coleogyne habitat on Plot 2 and Coleogyne habitat on Plot 4, as well as in the Chrysothamnus wash habitat below the Wildrose pond. Several Crotalus mitchelli were observed between the canyon top and the campground during the course of bird surveys.

# SECTION 4
# DISCUSSION

## 4.1 VEGETATION

Mountain Springs Canyon represents an elevational cline of about 670 m (2200 feet) that includes concomitant vegetational changes from Creosote Bush scrub at the mouth of the canyon to pinyon woodland at the highest elevations. The entire canyon area in past decades has been subjected to heavy Feral Burro impact. However within the last year, approximately 3500 individuals have been removed as a part of the Navy's Feral Burro management program.

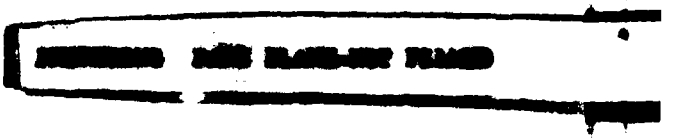
The bajada and the canyon mouth consists of sparse Creosote Bush scrub characteristic of the Mojave Desert. Most of the remainder of the canyon can be characterized as Transition Desert representing an intergrade between the Mojave and Great Basin Deserts (Beatley, 1976). Within this broad, generalized category there are several specific plant associations.

The Grayia-Lycium association occurred on the northwest-facing slope in the lower portion of the canyon. When the aspect changed from northwest to north in the upper portion of the canyon, there was an abrupt change to the Artemisia-Coleogyne association. On the south-facing slopes the Creosote Bush scrub community at the lower elevation grades into Haplopappus-Coleogyne habitat below Mammoth Mine.

The Blackbrush association as classified by Vasek and Barbour (1977) is a commonly used term but it is broad and ambiguous in definition. All of the above specific habitat associations would be contained in this Blackbrush category, yet Blackbrush is absent from the Grayia-Lycium association and subdominant in Artemisia-Coleogyne and Haplopappus-Coleogyne. Beatley (1976), however, recognizes separate Grayia-Lycium and Coleogyne associations within the Transition Desert category. Inasmuch as her classification fits the project area data best, we chose to follow her scheme. Artemisia tridentata is usually characteristic of the Great Basin Desert, but the Artemisia-Coleogyne association is ecotonal in nature and not sufficiently developed to warrant placing in any other category but Transition Desert.

The Joshua Tree ecotonal area in the upper portion of Mountain Springs Canyon crosses over both the Coleogyne and Artemisia-Coleogyne associations but does not occupy either of these associations fully. The Joshua Tree association is often treated as a separate community (Thorne, 1976; Vasek and Barbour, 1977). Other authorities point out that although Joshua Trees are visually dominant, their contribution to the





community structure is minimal (Beatley, 1976; Rowlands, 1978; Tables A-4, A-5). Data from the present study supports these latter authors, therefore the limits of distribution of Joshua Trees has been presented in Figure 3-1 for purposes of wildlife comparison but is not treated as a separate or distinct vegetative community.

Two specialized habitats were also present as small discrete patches throughout the canyon. These were desert wash and riparian habitats. The desert washes changed composition with elevation; the lower elevation washes were dominated by Atriplex, whereas higher elevation washes were dominated by Chrysothamnus. The riparian patches were dominated by Salix and Forestiera. It should be noted that although not extensive when compared to riparian areas throughout the southwest, the riparian areas within Mountain Springs Canyon represent one of the best riparian areas seen by the investigators within the China Lake complex.

Climatic conditions within the past year have been optimal and rainfall has been sufficient to produce high vegetative germination and productivity. With the significant decrease in Feral Burro impact in the area, much of the information gathered reflects initial post-burro recovery. In the present study a total of 86 perennial and 89 annual species were collected (Table A-1). This represents a total of 175 species in 6 plant habitat types. This species total compares favorably with the 180 species collected over a 10-year period by Mary Ann Henry (Beckingham et al., 1981) within the same canyon area. There were 122 species common to both studies. Of the 58 species unique to Henry's inventory, 1 additional species may be common to both, but she was unable to identify beyond genus. Likewise, of the 53 species unique to the present study, 7 additional species may be common to both, but only generic identification was possible at this time.

As an example of the degree of Feral Burro impact which has occurred in the area, we examined average shrub height for Ambrosia dumosa, a preferred burro food plant, from Mountain Springs Canyon and burro and non-burro areas elsewhere in the Mojave Desert (Table 4-1).

Data for Mountain Springs Canyon and Mojave "B" North are comparable and represent Feral Burro impact areas. The non-burro areas of Mojave "B" South and Upper Johnson Valley (near Victorville) demonstrate that when not browsed, Ambrosia dumosa may exhibit 50 percent more growth. It is expected that there will be a post-burro recovery period in the canyon which will result in increased plant productivity and vigor. The present study indicates that this recovery process may occur rapidly under optimal weather conditions. It would be useful to document the extent and speed of this process.

Table 4-1

AVERAGE HEIGHT (CM) OF AMBROSIA DUMOSA IN BURRO(*) AND NON-BURRO AREAS

| Mountain Springs Canyon* | Mojave "B" North[1]* | Mojave "B" South[1] | Upper Johnson Valley[2] |
|---|---|---|---|
| 14.05 | 10.84 | 28.93 | 22.58 |

[1]WESTEC Services, Inc. (1979)

[2]WESTEC Services, Inc. (1980)

## 4.2 AVIAN RESOURCES

Riparian habitats have long been recognized and exploited for their economic, recreational and aesthetic values by man. However, only recently have their importance to wildlife been documented (Johnson et al., 1977). Our data further supports this belief. Breeding bird populations were significantly higher in densities and diversities in the riparian areas when compared with the adjacent upland habitats. Several factors make riparian sites attractive: the presence of water, specific habitat requirements, floral and structural diversity, more favorable microclimate, and quality of the adjacent habitat (Stevens et al., 1977; Thomas et al., 1979). Studies have shown that increased structural diversity has a disproportionate effect on the addition of species primarily by the addition rather than the expansion of foraging guilds (Willson, 1979). The pronounced structural diversity of the riparian areas in Mountain Springs Canyon contrast dramatically with the relatively uniform upland areas. In addition, insect densities have been found to be significantly higher in riparian areas when compared with adjacent drier habitats (Goldberg, 1979).

It is difficult to compare our data with those reported by Beckingham et al. (1981) at China Lake for several reasons. Different census methods were used and their data are presented in terms of number/45 ha rather than the more traditional number of pairs/40 ha. In addition, it appears that previous censuses included both a composite of riparian and upland habitat. However, qualitatively we appear to have obtained similar species compositions in the two habitat types.

During the present study it was evident from the birds' behaviors (e.g., fighting, calling, presence of migrants) that the breeding populations were still being

established. Consequently, the number of species and individuals observed on each site may be underestimates of the actual breeding bird populations.

Riparian areas are also attractive to bird species of the adjacent areas. They are a source of higher quality food, nesting material and water. There tends to be a greater movement of birds from the uplands into the riparian areas and not in the opposite direction (Goldberg and Carothers, in press). Although this study did not permit quantitatively comparing the movements between habitats, it was evident that upland birds were utilizing the riparian areas.

Riparian areas are important not only to breeding birds but also to migrant species. In general, they serve as green beltways or islands along the migratory route. Although the study was conducted at the end of the migration period, their importance to migrants was evident. Eleven migrant species were observed in the riparian area compared to one species in the drier upland. The factors listed above for attractiveness of riparian habitats to breeding birds apply equally well for migrant birds.

Finally, the importance of riparian areas to the Inyo Brown Towhee cannot be underestimated. Although they appear to utilize the adjacent drier uplands for foraging (Cord and Jehl, 1979; this study), their presence appears limited by the availability of riparian vegetation. However, in contrast to Cord and Jehl (1979), a pair of Inyo Brown Towhees was observed foraging on the ground under dense willows on two occasions on the Upper Riparian site. Except for Mountain Spring, Inyo Brown Towhees were not observed at the other riparian areas within the main drainage of the canyon. However, due to time restrictions, these other areas were examined later in the day; avian activity is much reduced during the hotter portions of the day. Therefore, more Inyo Brown Towhees may inhabit the Mountain Springs Canyon area, including tributary canyons, than is reported in the present study.

The isolated Pinyon Pine woodland near the top of the canyon (Figure 3-1) may be viewed as a small green island habitat. It too may serve as an important stopover point for migrants and may possess a resident population distinct from the surrounding upland areas, as indicated by the presence of Scrub Jays and the Flammulated Owl.

Few raptors were observed during the study. Because of the limited time spent in the area, it is possible that they may be more abundant. However, lack of food availability, as evidenced by the depressed small mammal populations, tied in with the prior presence of large numbers of Feral Burros, is likely the reason. Vegetation recovery as a result of the removal of burros was evident during our sampling. It is likely that this increase in vegetation will be followed by small mammal recovery and may eventually result in greater numbers of raptors.

## 4.3 MAMMALS

A number of major animal taxa utilize seeds as a major food item. In desert habitats where bird and insect diversity is relatively low, small mammals serve as an important indicator of habitat type, quality of habitat, and provide the food base for higher trophic levels. Work conducted on the Mojave "B" Ranges provide an excellent example of how small mammal data can be used as a habitat indicator (WESTEC Services, Inc., 1979). Furthermore, since Feral Burros utilize the same basic food source as small mammals, the latter may be used as an accurate measurement of competitive habitat interactions (Carothers et al., 1976; O'Farrell, 1978).

It is important to note that there are a variety of factors that influence the trappability of small mammals (Smith et al., 1975) and that the presence of any of these factors will bias the final results. Aside from the fact that Feral Burro impact in the area was significant, the two factors that were present which could have affected trappability was the presence of a full moon and inclement weather. Moonlight is known to have a restrictive influence on activity and movements for desert rodents (Lockard and Owings, 1974; O'Farrell, 1974; Kaufman and Kaufman, 1982). The inclement weather experienced during the present study consisted of unseasonable cold, high winds, and intermittent rain, which was part of an extended unusual and unseasonable spring season in the Mojave Desert Region. Inasmuch as many of the species hibernate or curtail activities during such weather, we suspect some negative bias in our results.

Within the seven vegetative habitats occurring in Mountain Springs Canyon, the present study yielded 30 species of mammals. As would be expected, species richness and diversity was highest in habitats with the greatest substrate and vegetation structural diversity (Creosote Bush bajada and Artemisia-Coleogyne hillside). The Creosote Bush habitat at the lower portion of the canyon contained a characteristic species assemblage (Hall, 1946; Ingles, 1965) but numbers were low. The vegetation was in poor condition primarily due to high Feral Burro impact which probably accounts for low density and biomass values. In addition, the presence of a full moon and low temperatures would have limited normal activity levels. High populations of mammals elsewhere on the Naval Weapons Center (WESTEC Services, Inc., 1979) address the effect of Feral Burro impact.

The Coleogyne habitat sampled at Plot 2 was disappointing due to poor trap results in what appeared to be a fairly productive area. The vegetation was responding well to previous rainfall and lack of recent burro use but an examination for active rodent burrows suggested low populations which was borne out by trapping. The

presence of old woodrat nests and no captures would certainly suggest local extirpations of this species.

Plot 3 was Artemisia-Coleogyne habitat and contained a high degree of structural diversity due to numerous rock outcrops, ravines and variable canopy structure. This area was near sites sampled last summer (Beckingham et al., 1981). Their results were similar to the present study although species composition varied somewhat probably due to microhabitat differences encompassed by the respective trapping configurations. Numbers were low in the previous study but higher than in the present study which may be due to timing of the studies (July for Beckingham et al., 1981).

Plot 4 was in uniform Artemisia-Coleogyne habitat that lacked the structural diversity found on Plot 3. Rodent diversity was lower reflecting this lack of structural diversity. Trapping conducted by Phillips Brandt Reddick (1981) at nearby Birchum Spring indicates similarities to the present data but incorporated different habitat patches which contained several species not found on Plot 4. Species diversity and evenness between the two areas was comparable.

Sex ratios were strongly skewed in favor of males in the present study. In contrast, sex ratios reported by Beckingham et al. (1981) did not differ significantly from 1:1. This suggests that the inclement weather experienced in the present study was influencing rodent activity. In hibernating species, males are usually the first to emerge (O'Farrell, 1974; 1978). The timing of this study obviously had missed maximum population levels which would include the late summer period of recruitment of young into the population.

The bat fauna observed was comparable in composition to that reported by Surprenant (1978) for a canyon near Ballarat in the Panamint Mountains. Species richness was higher at Ballarat simply because that area was sampled during all months over a 2-year period, allowing for the capture of migrant species. The composition of species between the upper and lower portions of Mountain Springs Canyon differed totally. Roost sites for Plecotus townsendii and Myotis californicus were present in the lower mine tunnel and a utilizable water source in the form of a vertical shaft was present near the mine. Both species are capable of slow, highly manueverable flight and could easily negotiate the shaft in order to obtain water. The upper canyon was utilized mainly by Eptesicus fuscus, Tadarida brasiliensis, and Lasiurus cinereus. The latter two species are high aspect ratio, fast flying species which require a relatively open water source. The former species probably has a suitable maternity roost in the vicinity of the pond and therefore concentrates its activities in the area requiring the least energy expenditure.

The presence of a maternity colony of P. townsendii in the canyon is significant because this species is declining throughout its range primarily due to human disturbance. This bat demonstrates extreme susceptibility to human disturbance and will abandon the maternity roost with little provocation (Humphrey and Kunz, 1976). In addition, this is the last known maternity roost in the area since the colony in Wilson Canyon has moved (P. Brown, personal communication).

Predator populations were low throughout the canyon and little fresh sign (tracks or scat) were observed. This reflects the low small mammal and lagomorph populations recorded, indicating an insufficient predator food base. The only species that appeared to be thriving were ground squirrels which do particularly well in disturbed ecotonal areas such as roadways. However, the aspect of post-burro recovery including high plant productivity suggests a relatively rapid recruitment of small mammals in the near future.

## 4.4 AMPHIBIANS AND REPTILES

The present study added two lizard species (Callisaurus draconoides and Eumeces gilberti) and five snake species (Lichanura trivirgata, Masticophis taeniatus, Salvadora hexalepis, Pituophis melanoleucus, and Crotalus mitchelli) to the herpetofauna reported for Mountain Springs Canyon (Beckingham et al., 1981). However, inclement weather no doubt affected reptile emergence and activity which curtailed the quantity of data collected.

One of the surprising results of the study was the absence of amphibians. Investigators conducted nighttime and daytime surveys with negative results. Additionally, open water areas were checked for tadpoles with negative results. Because of the lateness of the spring, it is possible that this study was conducted at a time when amphibians were not yet active.

## 4.5 DISTRIBUTION OF SENSITIVE SPECIES

### 4.5.1 Plant Species

Plant species are considered to be sensitive if they are rare, endangered, threatened, of depleted or declining status, endemic, or of limited or unique distribution. Published lists used to identify sensitive species include the federally listed and proposed rare and endangered plants (United States Fish and Wildlife Service, 1980); state-listed rare and endangered vascular plants (California Department of Fish and Game, 1981); and the California Native Plant Society's (CNPS) inventory of rare and endangered vascular plants of California (Smith et al., 1980; 1981). The Smithsonian Institution's entire list of endangered and threatened plants of the United States

(Ayensu and DeFilipps, 1978) was incorporated by Congress into the above referenced federal list (USFWS, 1980), and will be referred to by the latter reference. An Environmental Impact Statement (EIS) prepared for the Naval Weapons Center (Phillips Brandt Reddick, 1981) contains a list of 30 sensitive species and accompanying sensitive plant map. Other sources used to evaluate the presence of sensitive species within the study area are a floristic inventory of Mountain Springs Canyon by Mary Ann Henry (Beckingham et al., 1981) and a flora of the Naval Weapons Center prepared by Mary DeDecker (1980).

No federal or state listed threatened, endangered, or rare plant species were observed during any of the transects or foot surveys within the study area. One species that was listed by the CNPS in 1974 (Powell, 1974) as "not rare but mostly of limited distribution" and reported from the canyon (Phillips Brandt Reddick, 1981) is Golden Eye (Viguiera reticulata). Golden Eye is a perennial sunflower which occurs in Creosote Bush scrub in the Coso and Argus Ranges. The species was found in the Coleogyne community and Creosote Bush scrub on the north-facing slope in the lower canyon, and was enumerated in Transect 2. The species is no longer considered sensitive, since the CNPS dropped this plant from its 1980 inventory (Smith et al., 1980) and the plant is found in various locations around Death Valley. It should be noted that this species is endemic to Inyo County.

Pholisma arenarium is a small, parasitic plant found at lower elevations in Creosote Bush scrub at several locations on the Naval Weapons Center and environs (DeDecker, 1980; Phillips Brandt Reddick, 1981). Pholisma is listed as proposed threatened by the U.S. Fish and Wildlife Service (1980) and "rare in California, but common elsewhere" by Smith et al. (1980). Although not observed during the study, Pholisma may occur in the Creosote Bush scrub in the lower canyon due to the presence of several of its host species,most notably Ambrosia dumosa. It has been our experience that this parasitic species varies in numbers from year to year with the species virtually nonexistent during one year, and several hundred individuals noted in the same area the following year. Only surveys of the area over a number of years could ascertain the occurrence or non-occurrence of this species within the area.

Mohave Fish-hook Cactus (Sclerocactus polyancistrus) is found in both the Coso and Argus Ranges (DeDecker, 1980). Its occurrence in the area is rare. The species is considered rare and endangered by Smith et al. (1980) and is on the federal proposed threatened list (USFWS, 1980). Although not observed during the survey, there is a potential that Sclerocactus could occur on south-facing slopes within the upper canyon area. Occurrence would be sporadic at best.

4.5.2 Animal Species

Animal species are considered to be sensitive if they are rare, endangered, threatened, of depleted or declining status, endemic, or of limited or unique distribution. Published lists used to identify sensitive species include the federally listed and proposed listed rare and endangered animals (USFWS, 1979); state-listed rare and endangered wildlife (California Fish and Game Commission, 1980); and the list of sensitive breeding birds of California (Remsen, 1979). An Environmental Impact Statement (EIS) prepared for the Naval Weapons Center (Phillips Brandt Reddick, 1981) contains a list of 24 sensitive animal species and accompanying distribution map. Other sources used to evaluate the presence of sensitive species within the study area are the California Desert Conservation Plan (BLM, 1980) and a species inventory of the Naval Weapons Center (Beckingham et al., 1981).

The Inyo Brown Towhee, a California listed endangered species (California Fish and Game Commission, 1980), is restricted to 12 canyon systems in the southern Argus Mountains (Cord and Jehl, 1979). This relict subspecies requires riparian habitat for shelter, breeding and foraging activities. Breeding pairs were observed at Mountain Spring, Upper Wildrose, and Upper Riparian avian study areas and as a transient on the Upland transect. It appears that a riparian patch must be of sufficient size to support a pair and many of the patches within the canyon appeared too small to support a breeding pair. The smallest riparian patch found supporting a breeding pair was approximately 50 feet by 1000 feet in size (approximately 1.15 acres).

Bell's Vireo (Vireo bellii) is a migratory species arriving in California at the end of March and remaining through August. This species has dramatically declined recently over its entire range due to reductions in its breeding habitat and cowbird parasitism. The species is now considered to be a rare and local resident of lowland riparian woodland in California (Garrett and Dunn, 1981). The species appears on the Audubon Blue-List (Tate, 1980) and is being recommended by some knowledgeable ornithologists for federal listing. The species is listed by Remsen (1979) as a highest priority species indicating the species faces immediate extirpation if current trends continue. Two races of the species are present in California, V.b. pusillus and V.b. arizonae. Least Bell's Vireo (V.b. pusillus) was recently listed as endangered by the California Fish and Game Commission (1980). The species has been previously recorded as breeding along the Amargosa River in Inyo County (subspecies undetermined) and only eight records exist in the northern deserts for spring and fall transients or vagrants (Garrett and Dunn, 1981). The race pusillus historically inhabited Owens and Death

Valleys as well as desert oases and riparian canyons in the Mojave Desert (Goldwasser, 1978). The race arizonae is normally found along the Colorado River. The races are not separable in the field (Garrett and Dunn, 1981). Two pairs of the species were observed at the Upper Wildrose avian study site and a pair was also recorded at the Mountain Springs site during the current study. It is known to breed in the riparian habitat in the canyon. It is noted that the Brown-headed Cowbird (Molothrus ater) was also observed in the canyon and is expected to breed there also. This species parasitizes the nests of the Bell's Vireo and is implicated as the primary cause of this species decline (Goldwasser, 1978).

Yellow Warbler and Black-tailed Gnatcatcher are listed as second priority species by Remsen (1979). Second priority species are on a decline throughout a large part of their range but populations are still sufficiently substantial that the danger is not immediate. The Yellow Warbler is an obligatory riparian species and is of declining status due to the rapid decline of riparian habitat in the Southwest. Furthermore, Yellow Warblers have been negatively affected by nest-parasitism by Brown-headed Cowbirds. Yellow Warblers were found at the Mountain Spring and Upper Riparian avian study sites. Black-tailed Gnatcatchers were observed on both upland transects. This species (Polioptila melanura lucida) is rare in the northern deserts (Garrett and Dunn, 1981).

Twenty-three additional species of birds restricted to riparian habitat were also observed (Table 3-2). All may be considered somewhat sensitive due to reliance on riparian habitat.

LeConte's Thrasher is listed as a third priority species by Remsen (1979). Third priority species are those which are not in present danger of extirpation, but by virtue of their small populations in California, they are potentially vulnerable. It occupies a restricted geographic range and breeds in desert wash habitats which have received negative impact from off-road vehicles over much of its distribution. LeConte's Thrasher was found in desert washes within the canyon.

Two species, Prairie Falcon and Sharp-shinned Hawk, listed by the California Fish and Game as species of special concern, have been sighted in Mountain Springs Canyon (Beckingham et al., 1981). In addition, the BLM (1980) shows the Argus Mountains as potential foraging range for Golden Eagles. These species were not observed in the present study, which may indicate a rather restricted or sporadic use of the canyon. Further work, particularly as the food base increases with post-burro recovery, is needed to clarify this situation.

The Flammulated Owl (Otus flammeolus) is a migratory species in California. It is a common to locally common summer resident arriving generally in May and staying through August. The earliest records are for mid-April and the latest records are for October. The species may overwinter but this is felt to be extremely rare. The preferred habitat for this species appears to be Yellow Pine forests. The only recorded instance of breeding outside of the Yellow Pine belt is of a juvenile found in 1932 in the Pinyon Pine belt of the Argus Mountains (Winter, 1979). Only one other record on Clark Mountain in northeastern San Bernardino County is known within the Great Basin Mountains faunal district (Winter, 1979). The species is not state or federally listed and it is not listed by Remsen (1979) as a declining breeding species in California. The presence of a single individual close to a patch of Pinyon Pine woodland in the upper aspect of Mountain Springs Canyon represents a unique sighting of this species and confirmation of its occasional presence in the Argus Range.

No federally or state-listed mammals were observed during the present study. However, two sensitive species could potentially occur in the vicinity (BLM, 1980). Mojave Ground Squirrels are known to occur at Ridgecrest and in the Coso Mountain Range. The habitat found in Mountain Springs Canyon appears to be suitable although the presence of the common California Ground Squirrel may negate the possibility of occurrence due to competitive pressures. The Argus Mountains are also given as potential range for Desert Bighorn Sheep. However, no sign of this species was observed during the present study.

An endemic subspecies of Panamint Kangaroo Rat (Dipodomys panamintinus argusensis) was collected in the upper half of the canyon. Although common in Coleogyne habitat, it is considered sensitive by BLM (1980) due to its endemic nature.

The Desert Tortoise (Gopherus agassizi) occurs within the Naval Weapons Center and is listed as a sensitive species (BLM, 1980). Although suitable habitat is present at the mouth of the canyon, no tortoises were observed. This area may be outside the range of this species.

## 4.6 SENSITIVE HABITATS

Mountain Springs Canyon represents a rather unique habitat in the northern desert area for a number of reasons. The area has a perennial water supply that supports a significant riparian habitat. Additionally, the area provides a number of diverse habitats due to altitudinal zonation and slope aspects. The mosaic of structurally diverse habitats and the strong ecotonal nature within the canyon also provides a base for an unusually diverse fauna.

Although Mountain Springs Canyon in general should be considered sensitive, the area has been divided into three categories of sensitivity in order to provide insight into resource planning. Figure 4-1 delineates these sensitivity categories. Each category is discussed below.

Category 1 contains the most sensitive resources. These areas should not be disturbed or altered without extensive study and formulation of mitigation measures. Areas within Category 1 include:

1. Riparian areas - These riparian areas are rather unique in the area, support a high diversity of wildlife including the state-endangered Inyo Brown Towhee and Bell's Vireo.
2. Mine Tunnel in Mountain Springs Canyon - This tunnel supports a maternity colony of Plecotus townsendii, a declining species.
3. Creosote ring area - The creosote rings are potentially very old, unique and should be preserved.
4. Pinyon Pine Woodland - These small islands of vegetation appear to be valuable wildlife islands supporting such species as the Flammulated Owl.

Category 2 is somewhat less sensitive than Category 1. Disturbance or alteration of these areas should be avoided as much as possible and only after evaluation of the area to be affected. Category 2 areas include:

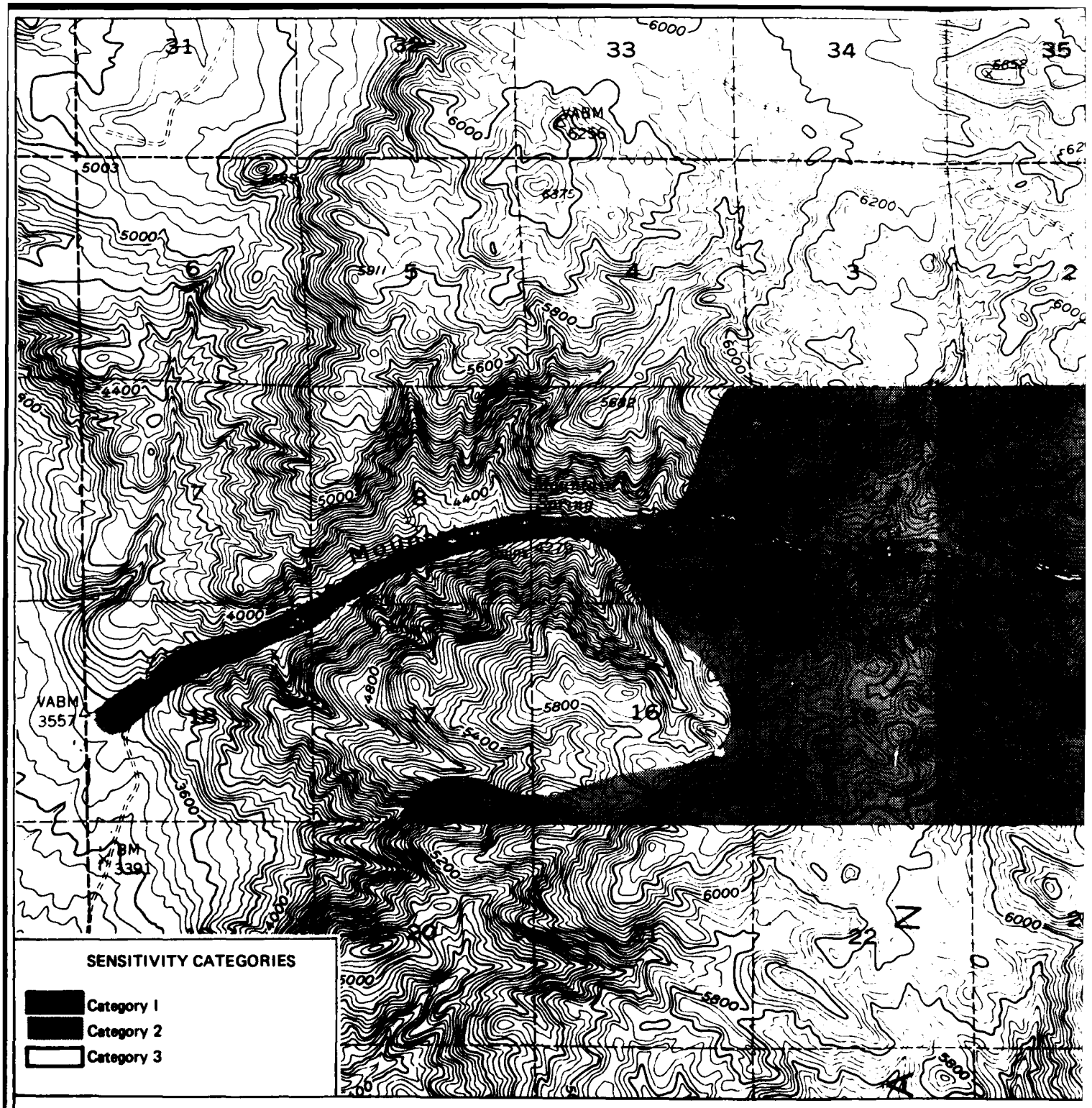
1. Desert Wash areas - Disturbance of these areas could affect water quality and quantity in riparian areas.
2. Blackbrush Community - This area supports the endemic Dipodomys panamintinus argusensis, a BLM sensitive species. Disturbance of large areas may incrementally affect the species.
3. Areas near Category 1 areas in order to serve as buffer for those sensitive habitats.

Sensitivity Category 3 can generally be disturbed if done in an environmentally sensitive manner. The remainder of the study area was given this ranking.

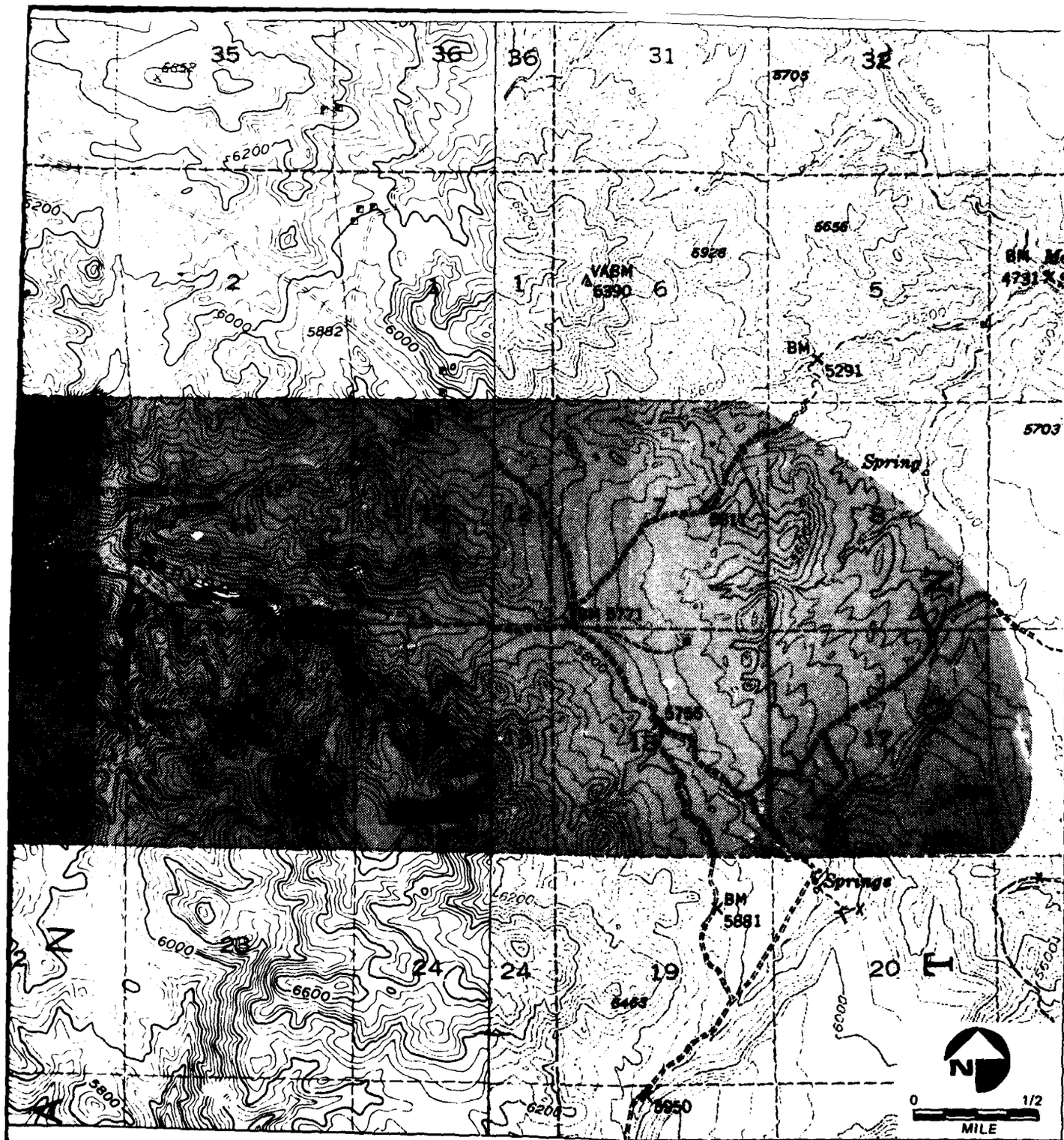
## 4.7 MANAGEMENT RECOMMENDATIONS

### 4.7.1 Management of Resources

It is recommended that areas in sensitivity Category 1 be protected from direct or indirect disturbances. The most disturbing element within the areas, Feral Burros, have been removed thus eliminating further impact caused by these animals. Military activities should be oriented away from these areas.




Sensitivity Mapping of Mountain Springs Ca




ing of Mountain Springs Canyon

**FIGURE 4-1**

Areas within Category 2 should be disturbed only after careful evaluation and disturbances of large amounts of habitat should be avoided. Areas in Category 3 can be disturbed if done in an environmentally sensitive manner.

It should be be noted that the Mountain Springs Canyon study area is in total a rather unique biological area. Any disturbances to the area should be small in nature in order to preserve the integrity of the canyon ecosystem.

4.7.2 Future Studies

The present study was limited in time and scope. Further field studies would be desireable to further document the resources in the area. These studies could include:

1. Continued sampling of Inyo Brown Towhee and Least Bell's Vireo throughout the spring and summer in order to more precisely determine habitat requirements and population estimates.
2. Continued springtime quantitative vegetation analysis in order to document vegetative recovery after removal of Feral Burros.
3. Multi-seasonal and multi-year wildlife studies in order to document species trends and obtain a better overall estimate of the wildlife resources of the area.

## SECTION 5

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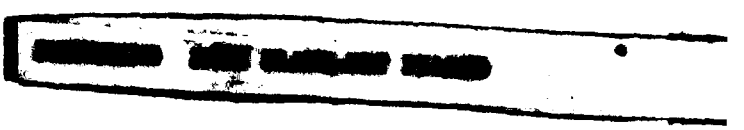
## SECTION 6

## STUDY TEAM ORGANIZATION

| | |
|---|---|
| Project Manager | John Westermeier<br>M.A. Biology |
| Project Coordinator | Stephen Lacy<br>M.S. Biology |
| Principal Investigator/Senior Mammalogist | Michael O'Farrell<br>Ph.D. Zoology |
| Senior Ornithologist | Nancy Goldberg<br>Ph.D. Zoology |
| Senior Botanist | Jack Fisher<br>M.S. Botany |
| Associate Biologists | Thomas Huffman<br>B.S. Biology |
| | Curt Uptain<br>M.S. Biology |



# SECTION 7

# APPENDIX

Table A-1

VEGETATION SPECIES LIST/OCCURRENCE BY PLANT COMMUNITY

| Family/Species | Common Name | Plant Community* CB | GL | AC | HC | W | R | P |
|---|---|---|---|---|---|---|---|---|
| **AGAVACEAE** | | | | | | | | |
| Yucca brevifolia | Joshua Tree (perennial) | | | X | X | | | |
| **AMARYLLIDACEAE** | | | | | | | | |
| Dichelostemma pulchella | Blue Dicks (perennial) | X | | X | X | | | |
| **APIACEAE** | | | | | | | | |
| Cymopterus panamintensis var. panamintensis | Parsnip (perennial) | | X | | | | | |
| Cymopterus sp. | Parsnip (perennial) | | | X | | | | X |
| **ASTERACEAE** | | | | | | | | |
| Ambrosia acanthicarpa | Sand Bur (annual) | | | | | X | | |
| Ambrosia dumosa | Burrobush (perennial) | X | X | | | X | | |
| Amphipappus fremontii | Chaff-Bush (perennial) | X | | | | | | |
| Artemisia ludoviciana | Western Mugwort (perennial) | | | X | | X | | |
| Artemisia tridentata | Big Sagebrush (perennial) | | | X | | X | | X |
| Baccharis glutinosa | Mule Fat (perennial) | | | | | | X | |
| Brickellia arguta | Spear-leaved Brickellia (perennial) | | X | | | | | |
| Brickellia desertorum | Desert Brickellia (perennial) | | | | | X | | |
| Chaenactis fremontii | Fremont Pincushion (annual) | | X | | X | X | | |
| Chaenactis stevioides | Broad-flowered Pincushion (annual) | X | | X | X | X | | |
| Chrysothamnus nauseosus | Mojave Rabbitbrush (perennial) | | | | | X | | |
| Chrysothamnus teretifolius | Terete-leaved Rabbitbrush (perennial) | | | X | | | | |

* See key, p. 69, for definitions of plant communities.

Table A-1 (Continued)

VEGETATION SPECIES LIST/OCCURRENCE BY PLANT COMMUNITY

| Family/Species | Common Name | Plant Community | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | CB | GL | AC | HC | W | R | P |
| **ASTERACEAE (Continued)** | | | | | | | | |
| Chrysothamnus viscidiflorus | Twisted Leaf Rabbitbrush (perennial) | | | X | | X | X | |
| Cirsium sp. | Thistle (perennial) | | | X | | | | |
| Coreopsis bigelovii | Bigelow Coreopsis (annual) | | | | X | | | |
| Encelia virginensis | Brittlebush (perennial) | X | X | | X | X | | |
| Eriophyllum ambiguum | Wooly Daisy (annual) | X | X | X | | | | |
| Eriophyllum pringlei | Bud Eriophyllum (annual) | | X | | | X | | |
| Eriophyllum wallacei | Easter Bonnets (annual) | | | X | | X | | |
| Gutierrezia microcephala | Matchweed (perennial) | | X | X | | X | | |
| Haplopappus cooperi | Cooper Goldenbush (perennial) | X | | | | | | |
| Haplopappus cuneatus | Cliff Goldenbush (perennial) | | | | | X | | |
| Haplopappus laricifolius | Goldenbush (perennial) | | X | | X | X | | |
| Haplopappus linearifolius | Linear-leaved Goldenbush (perennial) | | X | X | X | | | |
| Hymenoclea salsola var. salsola | Cheese-Bush (perennial) | X | X | | X | X | | |
| Layia glandulosa | White Tidy-Tips (annual) | | | X | | | | |
| Lepidospartum squamatum | Scale Broom (perennial) | | | | | X | | |
| Machaeranthera tortifolia | Desert Aster (perennial) | | X | | | | | |
| Malacothrix coulteri | Snakes Head (annual) | X | X | | X | | | |
| Malacothrix glabrata | Desert Dandelion (annual) | X | X | | X | X | | |
| Monoptilon bellioides | Desert Star (annual) | X | | | | | | |
| Rafinesquia neomexicana | Desert Chicory (annual) | X | | | | | | |
| Senecio douglasii var. monoensis | Sand-Wash Groundsel (perennial) | | | | | X | | |
| Sonchus asper | Prickly Sow-Thistle (annual) | | | | | | X | |
| Stephanomeria pauciflora | Desert-Straw (perennial) | | X | | | X | | |
| Stylocline micropoides | Desert Nest-Straw (annual) | X | | | X | | | |
| Syntrichopappus fremontii | Fremont Xerasid (annual) | | | | | X | | |
| Tetradymia spinosa var. longispinsoa | Cotton-Thorn (perennial) | X | | X | | | | |
| Viguiera reticulata | Leather-leaved Viguiera perennial) | X | X | | | | | |

Table A-1 (Continued)

VEGETATION SPECIES LIST/OCCURRENCE BY PLANT COMMUNITY

| Family/Species | Common Name | Plant Community | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | CB | GL | AC | HC | W | R | P |
| **BORAGINACEAE** | | | | | | | | |
| *Amsinckia tessellata* | Fiddleneck (annual) | X | X | | X | | | |
| *Cryptantha barbigera* | Fuzzy Forget-Me-Not (annual) | | X | | X | | | |
| *Cryptantha circumscissa* | Capped Forget-Me-Not (annual) | | X | X | X | | | |
| *Cryptantha micrantha* | Purple-Rooted Forget-Me-Not (annual) | X | | | | | | |
| *Cryptantha pterocarya* | Wing-Nut Forget-Me-Not (annual) | X | | | X | | | |
| *Cryptantha utahensis* | Fragrant Forget-Me-Not (annual) | | X | X | | | | |
| *Cryptantha* sp. | Forget-Me-Not (annual) | | | | | X | | |
| *Pectocarya platycarpa* | Broad-Toothed Comb-Bur (annual) | X | X | | | X | | |
| **BRASSICACEAE** | | | | | | | | |
| *Arabis pulchra* | Beautiful Rock-Cress (perennial) | | | X | | | | |
| *Caulanthus cooperi* | (annual) | | X | X | X | | | |
| *Descurainia pinnata* | Tansy-Mustard (annual) | | X | X | | X | | |
| *Descurainia sophia* | Flix Weed (annual) | | | | | | X | |
| *Erysimum capitatum* | Wallflower (perennial) | | | X | | | | |
| *Lepidium fremontii* | Desert Alyssum (perennial) | | X | | | | | |
| *Lepidium lasiocarpum* | Sand Peppergrass (annual) | X | X | | X | | X | |
| *Stanleya pinnata* | Desert Plume (perennial) | | | | | X | | |
| *Thysanocarpus laciniatus* var. *hitchcockii* | Fringe-Pod (annual) | | | | X | | | |
| **CACTACEAE** | | | | | | | | |
| *Echinocactus polycephalus* | Many Headed Barrel Cactus (perennial) | X | | | | | | |
| *Opuntia basilaris* | Beavertail Cactus (perennial) | X | X | X | X | | | |
| *Opuntia echinocarpa* | Thorny-Fruited Cactus (perennial) | | | X | | | | |

Table A-1 (Continued)

VEGETATION SPECIES LIST/OCCURRENCE BY PLANT COMMUNITY

| Family/Species | Common Name | Plant Community | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | CB | GL | AC | HC | W | R | P |
| **CAPRIFOLIACEAE** | | | | | | | | |
| Sambucus caerulea | Elderberry (perennial) | | | | | X | | |
| **CARYOPHYLLACEAE** | | | | | | | | |
| Arenaria sp. | Sandwort (perennial) | | | X | | | | |
| Silene sp. | Catchfly (perennial) | | | | | | | X |
| **CHENOPODIACEAE** | | | | | | | | |
| Atriplex canescens ssp. canescens | Wingscale, Hoary Saltbush (perennial) | | | | | X | | |
| Atriplex polycarpa | Saltbush, Cattle Spinach (perennial) | X | | | | X | | |
| Chenopodium album | Pigweed (annual) | | | | | X | | |
| Eurotia lanata | Winter Fat (perennial) | | X | | | | | |
| Grayia spinosa | Spiny Hop Sage (perennial) | | X | | | | | |
| **CONVOLVULACEAE** | | | | | | | | |
| Cuscuta sp. | Dodder (annual) | X | | | | | | |
| **CYPERACEAE** | | | | | | | | |
| Carex sp. | Sedge (perennial) | | | | | | | X |
| Eleocharis sp. | Spike-Rush (perennial) | | | | | | X | |
| **EPHEDRACEAE** | | | | | | | | |
| Ephedra nevadensis | Mormon Tea (perennial) | X | X | X | X | | | |
| Ephedra viridis | Mountain Joint-Fir (perennial) | | | X | X | | | X |

Table A-1 (Continued)

VEGETATION SPECIES LIST/OCCURRENCE BY PLANT COMMUNITY

| Family/Species | Common Name | Plant Community | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | CB | GL | AC | HC | W | R | P |
| **EUPHORBIACEAE** | | | | | | | | |
| Euphorbia albomarginata | Rattlesnake Weed (annual) | | | X | X | X | | |
| **FABACEAE** | | | | | | | | |
| Astragalus layneae | Layne Locoweed (perennial) | X | | | | | | |
| Astragalus purshii | Pursh Locoweed (annual) | | | X | | | | |
| Astragalus sp. | Milkvetch, Locoweed (annual) | X | | | | | | |
| Dalea fremontii var. fremontii | Indigo Bush (perennial) | X | X | | | | | |
| Lotus rigidus | Desert Rock-Pea (perennial | | | | X | | | |
| Lotus salsuginosus | Short-Winged Lotus (annual) | X | | | | | | |
| Lotus sp. | Lotus (annual) | | | X | | | | |
| Lupinus concinnus ssp. orcuttii | Elegant Lupine (annual) | | | X | X | X | | |
| Lupinus excubitus | Inyo Bush Lupine (perennial) | X | X | X | | X | | |
| **GERANEACEAE** | | | | | | | | |
| Erodium cicutarium | Filaree (annual) | X | X | | X | | | |
| **HYDROPHYLLACEAE** | | | | | | | | |
| Eucrypta chrysanthemifolia | Spotted Eucrypta (annual) | | X | | | | | |
| Nama demissum | Purple Mat (annual) | | | X | | X | | |
| Phacelia crenulata | Purple Phacelia (annual) | | | | | X | | |
| Phacelia distans | Wild Heliotrope (annual) | X | X | | | | | |
| Phacelia fremontii | Yellow Throats (annual) | X | | X | X | | | |
| Phacelia gymnoclada | Phacelia (annual) | | | | X | | | |
| Phacelia neglecta | Phacelia (annual) | | | | X | | | |
| Phacelia sp. | Phacelia (annual) | X | | | | | | |
| Tricardia watsonii | Three Hearts (perennial) | | | | | | | X |

Table A-1 (Continued)

VEGETATION SPECIES LIST/OCCURRENCE BY PLANT COMMUNITY

| Family/Species | Common Name | Plant Community CB | GL | AC | HC | W | R | P |
|---|---|---|---|---|---|---|---|---|
| **JUNCACEAE** | | | | | | | | |
| Juncus xiphioides | Irish-Leaved Rush (perennial) | | | | | | X | |
| **LAMIACEAE** | | | | | | | | |
| Hedeoma sp. | Mock Pennyroyal (annual) | | | | | | | X |
| Monardella linoides | Flax-Leaved Monardella (perennial) | | | | | | | X |
| Salazaria mexicana | Bladder Sage (perennial) | X | X | | X | X | | |
| Salvia carduacea | Thistle Sage (annual) | X | | | | | | |
| Salvia columbariae var. columbariae | Chia (annual) | X | | | X | | | |
| Salvia dorrii | Sage (perennial) | | | | X | | | X |
| **LOASACEAE** | | | | | | | | |
| Mentzelia albicaulis | Little Blazing Star (annual) | X | X | X | X | X | | |
| Mentzelia sp. | Blazing Star (annual) | | | X | | | | |
| **MALVACEAE** | | | | | | | | |
| Eremalche rotundifolia | Desert Fivespot (annual) | X | | | | | | |
| Sphaeralcea ambigua | Mohave Desert Mallow (perennial) | X | X | X | X | X | | |
| **NYCTAGINACEAE** | | | | | | | | |
| Mirabilis bigelovii | Wishbone Bush (perennial) | X | X | | X | | | |
| Mirabilis froebelii var. froebelii | Giant Four-O'Clock (perennial) | | | | X | | | |
| **OLEACEAE** | | | | | | | | |
| Forestiera neomexicana | Desert-Olive (perennial) | | | | | | X | |

Table A-1 (Continued)

VEGETATION SPECIES LIST/OCCURRENCE BY PLANT COMMUNITY

| Family/Species | Common Name | Plant Community | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | CB | GL | AC | HC | W | R | P |
| **ONAGRACEAE** | | | | | | | | |
| Camissonia boothii | Booth Primrose (annual) | X | | | | | | |
| Camissonia claviformis | Brown-Eyed Primrose (annual) | X | | | X | | | |
| Camissonia pusilla | Slender Hairy Primrose (annual) | | | X | | | | |
| Oenothera avita ssp. avita | California Primrose (annual) | | | X | | | | |
| **PAPAVERACEAE** | | | | | | | | |
| Argemone munita | Desert Prickly Poppy (perennial) | | | | | X | | |
| Eschscholzia minutiflora | Little Gold-Poppy (annual) | X | | | X | | | |
| **PINACEAE** | | | | | | | | |
| Pinus monophylla | Pinyon Pine (perennial) | | | | | | | X |
| **PLANTAGINACEAE** | | | | | | | | |
| Plantago insularis | Woolly Plantain (annual) | X | | | | | | |
| **POACEAE** | | | | | | | | |
| Bromus rubens | Foxtail Chess (annual) | X | X | X | X | X | | |
| Bromus tectorum | Cheat Grass (annual) | X | | X | X | X | | |
| Oryzopsis hymenoides | Ricegrass (perennial) | | | | | | | X |
| Poa fendleriana | Bluegrass (perennial) | | X | | | | | |
| Schismus arabicus | Arabian Schismus (annual) | X | | | | | X | |
| Sitanion hystrix | Squirreltail (perennial) | | X | | X | | | |
| Stipa speciosa | Desert Needlegrass (perennial) | X | X | | X | | | |

Table A-1 (Continued)

VEGETATION SPECIES LIST/OCCURRENCE BY PLANT COMMUNITY

| Family/Species | Common Name | Plant Community | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | CB | GL | AC | HC | W | R | P |
| **POLEMONIACEAE** | | | | | | | | |
| Eriastrum eremicum | Desert Eriastrum (annual) | X | | | X | | | |
| Gilia latiflora | Broad-Leaved Gilia (annual) | X | X | X | X | | | |
| Gilia ophthalmoides ssp. ophthalmoides | Pinyon Gilia (annual) | | | X | X | | | X |
| Gilia stellata | Dotted Throat Gilia (annual) | X | | X | X | | | |
| Gilia sp. | Gilia (annual) | | | | | X | | |
| Langloisia matthewsii | Sunbonnets (annual) | | | | | X | | |
| Langloisia punctata | Dotted Gilia (annual) | X | | | | | | |
| Linanthus aureus | Golden Linanthus (annual) | | | X | X | | | |
| Linanthus bigelovii | Bigelow Linanthus (annual) | | | | X | | | |
| Linanthus dichotomus | Evening Snow (annual) | | X | | | | | |
| Phlox viridis ssp. compacta | Compact Phlox (annual) | | | X | | | | |
| **POLYGONACEAE** | | | | | | | | |
| Chorizanthe brevicornu ssp. brevicornu | Brittle Chorizanthe (annual) | X | X | | | | | |
| Chorizanthe rigida | Rosy-Thorn (annual) | X | | | | | | |
| Chorizanthe thurberi | Red Triangles (annual) | | X | X | X | X | | |
| Eriogonum deflexum | Skeleton Weed (annual) | X | | | | | | |
| Eriogonum fasciculatum ssp. polifolium | California Buckwheat (perennial) | | X | X | X | | | |
| Eriogonum inflatum | Desert Trumpet (perennial) | X | | X | X | | | |
| Eriogonum maculatum | Wild Buckwheat (annual) | X | | | X | | | |
| Eriogonum mohavense | Mohave Buckwheat (annual) | X | | | | | | |
| Eriogonum nidularium | Whisk Broom Buckwheat (annual) | X | X | | | | | |
| Eriogonum nudum | Long Trumpet (perennial) | | X | | X | X | | |
| Eriogonum pusillum | Yellow Turbans (annual) | X | | | | | | |
| Eriogonum reniforme | Kidney Leaved Buckwheat (annual) | X | X | | | | | |
| Eriogonum trichopes | Little Trumpet (annual) | X | | | | | | |
| Eriogonum umbellatum | Buckwheat (perennial) | | | | | | | X |
| Eriogonum perfoliata | Chinese Hats (annual) | X | X | | | | | |

Table A-1 (Continued)

VEGETATION SPECIES LIST/OCCURRENCE BY PLANT COMMUNITY

| Family/Species | Common Name | Plant Community | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | CB | GL | AC | HC | W | R | P |
| **PORTULACACEAE** | | | | | | | | |
| Calyptridium monandrum | Sand-Cress (annual) | X | X | | X | X | | |
| Claytonia perfoliata | Miner's Lettuce (annual) | | | | | X | | |
| **PTERIDACEAE** | | | | | | | | |
| Cheilanthes covillei | Coville Lip Fern (annual) | | | | X | | | |
| **RANUNCULACEAE** | | | | | | | | |
| Delphinium parishii | Desert Larkspur (annual) | X | X | X | X | | | |
| **ROSACEAE** | | | | | | | | |
| Amelanchier utahensis | Service-Berry (perennial) | | | | | | | X |
| Coleogyne ramosissima | Blackbrush (perennial) | | | X | X | | | |
| Holodiscus microphyllus | Cream Bush (perennial) | | | | | | | X |
| Purshia glandulosa | Antelope-Brush (perennial) | | | X | X | | | X |
| **RUBIACEAE** | | | | | | | | |
| Galium sp. | Bedstraw (perennial) | | X | | | | | X |
| **SALICACEAE** | | | | | | | | |
| Populus fremontii | Fremont Cottonwood (perennial) | | | | | X | | |
| Salix lasiandra | Yellow Willow (perennial) | | | | | X | | |
| Salix lasiolepis | Arroyo Willow (perennial) | | | | | X | | |

Table A-1 (Continued)

VEGETATION SPECIES LIST/OCCURRENCE BY PLANT COMMUNITY

| Family/Species | Common Name | Plant Community | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | CB | GL | AC | HC | W | R | P |
| **SAXIFRAGACEAE** | | | | | | | | |
| Ribes velutinum | Gooseberry (perennial) | | | | | X | X | X |
| **SCROPHULARIACEAE** | | | | | | | | |
| Castilleja chromosa | Desert Paint Brush (perennial) | | | X | X | | | |
| Collinsia callosa | Granite Collinsia (annual) | | | X | | | | |
| Mimulus bigelovii | Bigelow Monkey-Flower (annual) | | | | X | | | |
| Mimulus guttatus | Common Monkey-Flower (annual) | | | | | | X | |
| Penstemon incertus | Western Desert Penstemon (perennial) | X | X | X | | X | | X |
| Penstemon speciosus | Showy Penstemon (perennial) | | | | | | | X |
| **SOLANACEAE** | | | | | | | | |
| Lycium andersonii | Anderson Thornbush (perennial) | X | X | | | X | | |
| Lycium cooperi | Peach-Thorn (perennial) | | X | | | X | | |
| Nicotiana trigonophylla | Tobacco (perennial) | X | X | | | | | |
| **ZYGOPHYLLACEAE** | | | | | | | | |
| Larrea tridentata | Creosote Bush (perennial) | X | X | | | X | | |

Table A-1 (Continued)

VEGETATION SPECIES LIST/OCCURRENCE BY PLANT COMMUNITY

**KEY**

| Plant Communities | | | Transect |
|---|---|---|---|
| Creosote Bush | - | CB | 1 |
| Grayia-Lycium | - | GL | 2 |
| Artemisia-Coleogyne | - | AC | 3 |
| Haplopappus-Coleogyne | - | H-L | 4 |
| Wash | - | W | 5 |
| Riparian | - | R | - |
| Pinyon Woodland | - | P | - |

Nomenclature follows Munz (1974).

Table A-2

PERENNIAL PLANT DENSITY, FREQUENCY OF OCCURRENCE, COVER, IMPORTANCE VALUE, AND MEAN HEIGHT FOR TRANSECT 1
(Annual Plant Density and Ground Cover Are Also Given)

| Perennial Species | Density #/900 $m^2$ | Relative Density | Cover $m^2$/150 $m^2$ | Relative Cover | Frequency (percent) | Relative Frequency | Importance Value | Mean Height (cm) |
|---|---|---|---|---|---|---|---|---|
| Ambrosia dumosa | 457 | 76.94 | 5.54 | 15.33 | 100.00 | 15.00 | 107.27 | 14.05 |
| Atriplex polycarpa | 25 | 4.20 | 0.41 | 1.13 | 33.33 | 5.00 | 10.33 | 57.00 |
| Dalea fremontii | 4 | 0.67 | — | — | 33.33 | 5.00 | 5.67 | — |
| Ephedra nevadensis | 3 | 0.50 | — | — | 33.33 | 5.00 | 5.50 | — |
| Haplopappus cooperi | 3 | 0.50 | — | — | 33.33 | 5.00 | 5.50 | — |
| Hymenoclea salsola | 19 | 3.20 | 0.32 | 0.89 | 33.33 | 5.00 | 9.09 | 37.00 |
| Larrea tridentata | 70 | 11.78 | 29.07 | 80.46 | 100.00 | 15.00 | 107.18 | 114.02 |
| Lycium andersonii | 3 | 0.50 | 0.79 | 2.19 | 66.67 | 10.00 | 12.69 | 47.00 |
| Mirabilis bigelovii | 3 | 0.50 | — | — | 33.33 | 5.00 | 5.50 | — |
| Opuntia basilaris | 3 | 0.50 | — | — | 100.00 | 15.00 | 15.50 | — |
| Tetradymia spinosa var. longispinosa | 1 | 0.17 | — | — | 100.00 | 15.00 | 15.17 | — |
| dead | 3 | 0.50 | — | — | — | — | — | — |
| TOTAL | 594 | 100.00 | 36.13 | 100.00 | 666.65 | 100.00 | — | — |

| Annual Species | Density (Individuals/15 $m^2$) |
|---|---|
| Amsinckia tessellata | 7 |
| Bromus rubens | 112 |
| Bromus tectorum | 3 |
| Calyptridium monandrum | 1 |
| Chaenactis stevioides | 67 |
| Chorizanthe brevicornu | 97 |
| Chorizanthe rigida | 6 |
| Cryptantha micrantha | 1 |
| Cryptantha pterocarya | 9 |
| Eriastrum eremicum | 29 |
| Eriogonum inflatum | 2 |
| Eriogonum maculatum | 3 |
| Eriogonum pusillum | 6 |
| Eriogonum reniforme | 1 |
| Eriophyllum ambiguum | 23 |
| Erodium cicutarium | 196 |
| Gilia stellata | 12 |
| Lepidium lasiocarpum | 25 |
| Lotus salsuginosus | 28 |
| Monoptilon bellioides | 2 |
| Oxytheca perfoliata | 2 |
| Pectocarya platycarpa | 58 |

| Annual Species | Density (Individuals/15 $m^2$) |
|---|---|
| Phacelia sp. | 2 |
| Plantago insularis | 2 |
| Salvia columbariae | 4 |
| Schismus arabicus | 2,776 |
| Stylocline micropoides | 6 |
| unknown Asteraceae | 2 |
| unknown Asteraceae | 2 |
| unknown Cruciferae | 12 |

| % Ground Cover | $\bar{X}$ |
|---|---|
| bare ground | 43.87 |
| small rock | 29.60 |
| rock | 20.40 |
| litter | 6.13 |

Table A-3

PERENNIAL PLANT DENSITY, FREQUENCY OF OCCURRENCE, COVER, IMPORTANCE VALUE, AND MEAN HEIGHT FOR TRANSECT 2
(Annual Plant Density and Ground Cover Are Also Given)

| Perennial Species | Density #/900 $m^2$ | Relative Density | Cover $m^2$/150 $m^2$ | Relative Cover | Frequency (percent) | Relative Frequency | Importance Value | Mean Height (cm |
|---|---|---|---|---|---|---|---|---|
| Ambrosia dumosa | 4 | 0.50 | — | — | 66.67 | 3.77 | 4.27 | — |
| Brickellia arguta | 9 | 1.13 | 0.91 | 1.90 | 66.67 | 3.77 | 6.80 | 31.25 |
| Dalea fremontii | 2 | 0.25 | — | — | 33.33 | 1.89 | 2.14 | — |
| Encelia virginensis | 12 | 1.50 | 0.07 | 0.15 | 33.33 | 1.89 | 3.54 | 24.00 |
| Ephedra nevadensis | 23 | 2.88 | 1.70 | 3.55 | 66.67 | 3.77 | 10.20 | 37.80 |
| Eriogonum fasciculatum | 43 | 5.38 | 2.09 | 4.37 | 100.00 | 5.66 | 15.41 | 41.58 |
| Eurotia lanata | 59 | 7.38 | 3.41 | 7.13 | 100.00 | 5.66 | 20.17 | 48.56 |
| Galium sp. | 1 | 0.13 | — | — | 33.33 | 1.89 | 2.02 | — |
| Grayia spinosa | 148 | 18.52 | 15.02 | 31.39 | 100.00 | 5.66 | 55.57 | 59.00 |
| Gutierrezia microcephala | 16 | 2.0 | 0.65 | 1.36 | 33.33 | 1.89 | 5.25 | 29.20 |
| Haplopappus laricifolius | 12 | 1.50 | 6.17 | 12.89 | 33.33 | 1.89 | 16.28 | 69.00 |
| Haplopappus linearifolius | 22 | 2.75 | 1.82 | 3.80 | 66.67 | 3.77 | 10.32 | 40.71 |
| Hymenoclea salsola | 46 | 5.75 | 2.40 | 5.02 | 66.67 | 3.77 | 14.54 | 42.15 |
| Larrea tridentata | 2 | 0.25 | — | — | 33.33 | 1.89 | 2.14 | — |
| Lepidium fremontii | 4 | 0.50 | 0.29 | 0.61 | 33.33 | 1.89 | 3.00 | 20.00 |
| Lycium andersonii | 31 | 3.88 | 2.70 | 5.64 | 100.00 | 5.66 | 15.18 | 50.14 |
| Lycium cooperi | 14 | 1.75 | 1.73 | 3.62 | 100.00 | 5.66 | 11.03 | 90.00 |
| Machaeranthera tortorfolia | 64 | 8.00 | 0.23 | 0.48 | 100.00 | 5.66 | 14.14 | 26.60 |
| Mirabilis bigelovii | 3 | 0.38 | 0.06 | 0.13 | 33.33 | 1.89 | 2.40 | 30.00 |
| Opuntia basilaris | 1 | 0.13 | 0.15 | 0.31 | 33.33 | 1.89 | 2.33 | 36.00 |
| Poa fendleriana | 92 | 11.51 | 0.94 | 1.96 | 100.00 | 5.66 | 19.13 | 42.17 |
| Salazaria mexicana | 50 | 6.25 | 5.44 | 11.37 | 100.00 | 5.66 | 23.28 | 59.29 |
| Sitanion hystrix | 10 | 1.25 | 0.16 | 0.33 | 66.67 | 3.77 | 5.35 | 45.00 |
| Sphaeralcea ambigua | 1 | 0.13 | 0.20 | 0.42 | 33.33 | 1.89 | 2.44 | 30.00 |
| Stephanomeria pauciflora | 36 | 4.50 | 0.34 | 0.71 | 100.00 | 5.66 | 10.87 | — |
| Stipa speciosa | 73 | 9.13 | 1.37 | 2.86 | 100.00 | 5.66 | 17.65 | 23.22 |
| Viguiera reticulata | 3 | 0.38 | — | — | 33.33 | 1.89 | 2.27 | — |
| dead | 17 | 2.13 | — | — | — | — | — | — |
| TOTAL | 798 | 100.00 | 47.86 | 100.00 | 1766.75 | 100.00 | — | — |

Table A-3 (Continued)

PERENNIAL PLANT DENSITY, FREQUENCY OF OCCURRENCE, COVER, IMPORTANCE VALUE, AND MEAN HEIGHT FOR TRANSECT 2
(Annual Plant Density and Ground Cover Are Also Given)

| Annual Species | Density (Individuals/15 $m^2$) | % Ground Cover | $\bar{X}$ |
|---|---|---|---|
| Amsinckia tessellata | 8 | bare ground | 14.67 |
| Bromus rubens | 1,779 | small rock | 20.40 |
| Chaenactis fremontii | 4 | rock | 55.27 |
| Chorizanthe brevicornu | 2 | litter | 9.67 |
| Chorizanthe thurberi | 14 | | |
| Cryptantha barbigera | 2 | | |
| Cryptantha utahensis | 31 | | |
| Cymopteris panamintensis | 1 | | |
| Descurainia pinnata | 3 | | |
| Eriogonum nidarium | 6 | | |
| Eriophyllum ambiguum | 27 | | |
| Erodium cicutarium | 2 | | |
| Eucrypta chrysanthemifolia | 2 | | |
| Gilia latiflora | 52 | | |
| Lepidium lasiocarpum | 1 | | |
| Linanthus dichotomus | 1 | | |
| Oxytheca perfoliata | 1 | | |
| Pectocarya platycarpa | 3 | | |
| Phacelia distans | 20 | | |
| unknown Cruciferae | 3 | | |

Table A-4

PERENNIAL PLANT DENSITY, FREQUENCY OF OCCURRENCE, COVER, IMPORTANCE VALUE, AND MEAN HEIGHT FOR TRANSECT 3
(Annual Plant Density and Ground Cover Are Also Given)

| Perennial Species | Density #/900 $m^2$ | Relative Density | Cover $m^2$/150 $m^2$ | Relative Cover | Frequency (percent) | Relative Frequency | Importance Value | Mean Height (cm) |
|---|---|---|---|---|---|---|---|---|
| Artemisia tridentata | 225 | 33.99 | 23.68 | 38.50 | 100.00 | 12.00 | 83.83 | 53.37 |
| Chrysothamnus viscidiflorus | 16 | 2.42 | 0.22 | 0.36 | 33.33 | 4.00 | 6.78 | 19.00 |
| Coleogyne ramosissima | 143 | 21.60 | 14.20 | 23.09 | 100.00 | 12.00 | 56.69 | 57.40 |
| Ephedra nevadensis | 15 | 2.27 | 0.50 | 0.81 | 100.00 | 12.00 | 15.08 | 44.33 |
| Ephedra viridis | 17 | 2.57 | 1.40 | 2.28 | 100.00 | 12.00 | 16.85 | 57.67 |
| Eriogonum fasciculatum | 43 | 6.50 | 10.16 | 16.52 | 33.33 | 4.00 | 27.02 | 23.46 |
| Gutierrezia microcephala | 8 | 1.21 | 1.10 | 1.79 | 33.33 | 4.00 | 7.00 | 35.71 |
| Haplopappus linearifolius | 2 | 0.30 | — | — | 33.33 | 4.00 | 4.30 | — |
| Opuntia basilaris | 2 | 0.30 | — | — | 33.33 | 4.00 | 4.30 | — |
| Penstemon incertus | 1 | 0.15 | — | — | 33.33 | 4.00 | 4.15 | — |
| Purshia glandulosa | 30 | 4.53 | 9.80 | 15.93 | 100.00 | 12.00 | 32.46 | 90.80 |
| Tetradymia spinosa var. longispinosa | 1 | 0.15 | — | — | 33.33 | 4.00 | 4.15 | — |
| Yucca brevifolia | 5 | 0.76 | — | — | 33.33 | 4.00 | 4.76 | — |
| perennial grass | 112 | 16.92 | 0.45 | 0.73 | 66.67 | 8.00 | 25.65 | 25.38 |
| dead | 42 | 6.34 | — | — | — | — | — | — |
| TOTAL | 662 | 100.00 | 61.51 | 100.00 | 833.31 | 100.00 | — | — |

| Annual Species | Density (Individuals/15 $m^2$) |
|---|---|
| Astragalus purshii | 1 |
| Bromus rubens | 8 |
| Bromus tectorum | 68 |
| Camissonia pusilla | 77 |
| Chorizanthe thurberi | 18 |
| Collinsia callosa | 108 |
| Cryptantha circumscissa | 13 |
| Cymopterus sp. | 3 |
| Dichelostemma pulchella | 2 |
| Euphorbia albomarginata | 10 |
| Gilia latiflora | 298 |
| Gilia ophthalmoides | 26 |
| Layia glandulosa | 21 |
| Linanthus aureus | 99 |
| Lotus sp. | 443 |
| Mentzelia albicaulis | 14 |

| Annual Species | Density (Individuals/15 $m^2$) |
|---|---|
| Mentzelia sp. | 11 |
| Nama demissum | 4 |
| Phlox viridis | 27 |
| unknown | 22 |

| % Ground Cover | $\bar{X}$ |
|---|---|
| bare ground | 58.60 |
| small rock | 29.60 |
| rock | 0.87 |
| litter | 30.93 |

Table A-5

PERENNIAL PLANT DENSITY, FREQUENCY OF OCCURRENCE, COVER, IMPORTANCE VALUE, AND MEAN HEIGHT FOR TRANSECT 4
(Annual Plant Density and Ground Cover Are Also Given)

| Perennial Species | Density #/900 $m^2$ | Relative Density | Cover $m^2$/150 $m^2$ | Relative Cover | Frequency (percent) | Relative Frequency | Importance Value | Mean Height (cm) |
|---|---|---|---|---|---|---|---|---|
| Coleogyne ramosissima | 121 | 15.28 | 8.06 | 14.23 | 100.00 | 9.38 | 38.89 | 51.54 |
| Encelia virginensis | 1 | 0.13 | — | — | 33.33 | 3.13 | 3.26 | — |
| Ephedra nevadensis | 28 | 3.54 | 1.58 | 2.79 | 66.67 | 6.25 | 12.58 | 33.71 |
| Ephedra viridis | 10 | 1.26 | — | — | 66.67 | 6.25 | 7.51 | — |
| Eriogonum fasciculatum | 139 | 17.55 | 6.16 | 10.88 | 100.00 | 9.38 | 37.81 | 37.31 |
| Haplopappus laricifolius | 123 | 15.53 | 18.50 | 32.66 | 100.00 | 9.38 | 57.57 | 58.72 |
| Haplopappus linearifolius | 82 | 10.35 | 8.95 | 15.80 | 100.00 | 9.38 | 35.53 | 47.50 |
| Hymenoclea salsola | 4 | 0.51 | 0.26 | 0.45 | 66.67 | 6.25 | 7.21 | 35.33 |
| Lotus rigidus | 204 | 25.76 | 7.69 | 13.58 | 100.00 | 9.38 | 48.72 | 43.64 |
| Opuntia basilaris | 1 | 0.13 | — | — | 33.33 | 3.13 | 3.26 | — |
| Poa scabrella | 4 | 0.51 | — | — | 33.33 | 3.13 | 3.64 | — |
| Salazaria mexicana | 42 | 5.30 | 5.44 | 9.60 | 100.00 | 9.38 | 24.28 | 63.59 |
| Sitanion hystrix | 19 | 2.40 | — | — | 33.33 | 3.13 | 5.53 | — |
| Yucca brevifolia | 1 | 0.13 | — | — | 33.33 | 3.13 | 3.26 | — |
| dead | 13 | 1.64 | — | — | 100.00 | 9.38 | 11.02 | — |
| TOTAL | 792 | 100.0 | 56.64 | 100.00 | 1,068.66 | 100.06 | — | — |

| Annual Species | Density (Individuals/15 $m^2$) | Annual Species | Density (Individuals/15 $m^2$) |
|---|---|---|---|
| Amsinckia tessellata | 1 | Euphorbia albomarginata | 9 |
| Bromus rubens | 664 | Gilia latiflora | 56 |
| Bromus tectorum | 572 | Gilia ophthalmoides | 80 |
| Calyptridium monandrum | 9 | Gilia stellata | 1 |
| Camissonia claviformis | 1 | Linanthus aureus | 7 |
| Chaenactis fremontii | 7 | Lupinus concinnus | 1 |
| Chorizanthe thurberi | 1 | Malacothrix glabrata | 3 |
| Coreopsis bigelovii | 4 | Mentzelia albicaulis | 3 |
| Cryptantha barbigera | 1 | Phacelia fremontii | 14 |
| Cryptantha circumscissa | 29 | Phacelia neglecta | 4 |
| Cryptantha pterocarya | 2 | Salvia columbariae | 8 |
| Cryptantha utahensis | 7 | Thysanocarpus laciniatus | 1 |
| Delphinium parishii | 1 | | |
| Dichelostemma pulchella | 16 | | |
| Erigstrum eremicum | 1 | % Ground Cover | $\bar{X}$ |
| Eriogonum maculatum | 2 | bare ground | 65.27 |
| Eriogonum nidularium | 2 | small rock | 10.53 |
| Eriophyllum ambiguum | 45 | rock | 8.13 |
| Erodium cicutarium | 4 | litter | 16.07 |

Table A-6

PERENNIAL PLANT DENSITY, FREQUENCY OF OCCURRENCE, COVER, IMPORTANCE VALUE, AND MEAN HEIGHT FOR TRANSECT 5
(Annual Plant Density and Ground Cover Are Also Given)

| Perennial Species | Density #/900 $m^2$ | Relative Density | Cover $m^2$/100 $m^2$ | Relative Cover | Frequency (percent) | Relative Frequency | Importance Value | Mean Height (cm) |
|---|---|---|---|---|---|---|---|---|
| Ambrosia dumosa | 1 | 0.37 | — | — | 50.00 | 4.17 | 4.54 | — |
| Artemisia tridentata | 1 | 0.37 | — | — | 50.00 | 4.17 | 4.54 | — |
| Atriplex canescens | 10 | 3.72 | 0.02 | 0.03 | 50.00 | 4.17 | 7.89 | 15.00 |
| Atriplex polycarpa | 98 | 36.43 | 59.53 | 84.92 | 100.00 | 8.33 | 129.68 | 44.38 |
| Chrysothamnus nauseosus | 75 | 27.88 | 6.62 | 9.38 | 50.00 | 4.17 | 41.43 | 48.88 |
| Encelia virginensis | 6 | 2.23 | — | — | 50.00 | 4.17 | 6.40 | — |
| Gutierrezia microcephala | 1 | 0.37 | — | — | 50.00 | 4.17 | 4.54 | — |
| Haplopappus laricifolius | 3 | 1.12 | — | — | 100.00 | 8.33 | 9.45 | — |
| Hymenoclea salsola | 21 | 7.81 | 1.80 | 2.55 | 100.00 | 8.33 | 18.69 | 38.13 |
| Larrea tridentata | 1 | 0.37 | — | — | 50.00 | 4.17 | 4.54 | — |
| Lepidospartum squamatum | 1 | 0.37 | — | — | 50.00 | 4.17 | 4.54 | — |
| Lotus sp. | 1 | 0.37 | — | — | 50.00 | 4.17 | 4.54 | — |
| Lycium andersonii | 1 | 0.37 | — | — | 50.00 | 4.17 | 4.54 | — |
| Lycium cooperi | 4 | 1.49 | — | — | 100.00 | 8.33 | 9.82 | — |
| Penstemon incertus | 2 | 0.74 | — | — | 50.00 | 4.17 | 4.91 | — |
| Salazaria mexicana | 1 | 0.37 | 0.29 | 0.41 | 50.00 | 4.17 | 4.54 | 64.00 |
| Senecio douglasii | 27 | 10.04 | 2.14 | 3.03 | 100.00 | 8.33 | 21.40 | 45.83 |
| Stanleya pinnata | 6 | 2.23 | 0.14 | 0.20 | 50.00 | 4.17 | 6.60 | 52.00 |
| Stephanomeria pauciflora | 3 | 1.12 | 0.03 | 0.04 | 50.00 | 4.17 | 5.33 | 20.50 |
| dead | 6 | 2.23 | — | — | — | — | — | — |
| TOTAL | 269 | 100.00 | 70.57 | 100.00 | 1,200.00 | 100.00 | — | — |

| Annual Species | Density (Individuals/15 $m^2$) |
|---|---|
| Bromus rubens | 565 |
| Bromus tectorum | 12 |
| Chaenactis stevioides | 2 |
| Chorizanthe thurberi | 4 |
| Cryptantha sp. | 8 |
| Descurainia pinnata | 20 |
| Euphorbia albomarginata | 3 |
| Gilia sp. | 2 |
| Malacothrix glabrata | 8 |
| Mentzelia albicaulis | 1 |
| Pectocarya platycarpa | 10 |
| Schismus arabicus | 1,700 |

| % Ground Cover | $\bar{X}$ |
|---|---|
| bare ground | 45.1 |
| small rock | 26.5 |
| rock | 4.2 |
| litter | 24.2 |

Table A-7

ESTIMATION OF PLANT SPECIES COMPOSITION IN RIPARIAN HABITAT ALONG THE CENTRAL DRAINAGE COURSE THROUGH MOUNTAIN SPRINGS CANYON*

| Riparian Patch Number | Number of Individuals/Approximate Percent Cover | | | |
|---|---|---|---|---|
| | Salix lasiolepis | Salix lasiandra | Forestiera neomexicana | Populus fremontii |
| 1 (lower canyon) | — | 4/100% | — | — |
| 2 | — | 8/100% | — | — |
| 3 | 34/80% | 20/20% | — | — |
| 4 | 10/15% | 43/85% | — | — |
| 5 | 4/40% | 6/60% | — | — |
| 6 | 6/70% | 2/30% | — | — |
| 7 | 4/50% | — | 5/50% | — |
| 8 | 2/100% | — | — | — |
| 9 | 8/70% | 5/30% | — | — |
| 10 | 6/60% | 72/38% | 2/2% | — |
| 11 | 15/98% | 1/2% | — | — |
| 12 | 2/10% | — | 9/80% | — |
| 13 | 7/100% | — | — | — |
| 14 | 7/75% | 1/10% | 2/5% | 1/10% |
| 15 (upper canyon) | 2/35% | — | 46/65% | — |
| Total/Average | 107/51.20% | 162/31.67% | 64/13.47% | 1/0.66% |

*Analysis included only those patches of riparian habitat along the drainage in the center of the canyon, alongside the main road. Not included are riparian areas located in the smaller tributary drainages.

Table A-8

BIRD SPECIES OBSERVED IN MOUNTAIN SPRINGS CANYON

| Common Name[1] | Scientific Name[1] |
|---|---|
| Red-tailed Hawk | Buteo jamaicensis |
| American Kestrel | Falco sparverius |
| California Quail | Lophortyx californicus |
| Mountain Quail | Oreortyx pictus |
| Chukar | Alectoris chukar |
| Band-tailed Pigeon[2] | Columba fasciata |
| Mourning Dove | Zenaida macroura |
| Roadrunner | Geococcyx californianus |
| Flammulated Owl | Otus flammeolus |
| Great Horned Owl | Bubo virginianus |
| Poor-will | Phalaenoptilus nuttallii |
| Costa's Hummingbird | Calypte costae |
| Common Flicker | Colaptes auratus |
| Acorn Woodpecker[2] | Melanerpes formicivorus |
| Ladder-backed Woodpecker[2] | Picoides scalaris |
| Western Kingbird | Tyrannus verticalis |
| Ash-throated Flycatcher[2] | Myiarchus cinerascens |
| Say's Phoebe[2] | Sayornis saya |
| Empidonax | Empidonax sp. |
| Western Wood Pewee[2] | Contopus sordidulus |
| Horned Lark | Eremophila alpestris |
| Barn Swallow | Hirundo rustica |
| Scrub Jay | Aphelocoma coerulescens |
| Common Raven | Corvus corax |
| Common Bushtit[2] | Psaltriparus minimus |
| Red-breasted Nuthatch[2] | Sitta canadensis |
| Bewick's Wren[2] | Thryomanes bewickii |
| Cactus Wren | Campylorhynchus brunneicapillus |
| Rock Wren | Salpinctes obsoletus |
| Mockingbird | Mimus polyglottos |

Table A-8 (Continued)

BIRD SPECIES OBSERVED IN MOUNTAIN SPRINGS CANYON

| Common Name[1] | Scientific Name[1] |
|---|---|
| Le Conte's Thrasher | Toxostoma lecontei |
| Sage Thrasher | Oreoscoptes montanus |
| American Robin[2] | Turdus migratorius |
| Blue-gray Gnatcatcher[2] | Polioptila caerulea |
| Black-tailed Gnatcatcher[2] | Polioptila melaneura |
| Ruby-crowned Kinglet[2] | Regulus calendula |
| Loggerhead Shrike | Lanius ludovicianus |
| Starling | Sturnus vulgaris |
| Bell's Vireo[2] | Vireo bellii |
| Solitary Vireo | Vireo solitarius |
| Warbling Vireo[2] | Vireo gilvus |
| Orange-crowned Warbler[2] | Vermivora celata |
| Yellow Warbler[2] | Dendroica petechia |
| Yellow-rumped Warbler | Dendroica coronata |
| Black-throated Gray Warbler[2] | Dendroica nigrescens |
| Townsend's Warbler[2] | Dendroica townsendi |
| MacGillivray's Warbler[2] | Oporornis tolmiei |
| Wilson's Warbler | Wilsonia pusilla |
| Western Meadowlark | Sturnella neglecta |
| Scott's Oriole | Icterus parisorum |
| Brown-headed Cowbird | Molothrus ater |
| Western Tanager[2] | Piranga ludoviciana |
| Black-headed Grosbeak[2] | Pheuticus melanocephalus |
| Lazuli Bunting | Passerina amoena |
| House Finch | Carpodacus mexicanus |
| Lesser Goldfinch | Carduelis psaltria |
| Rufous-sided Towhee | Pipilo erythrophthalmus |
| Inyo Brown Towhee[2] | Pipilo fuscus eremophilus |
| Rufous-crowned Sparrow[2] | Aimophila ruficeps |
| Black-throated Sparrow | Amphispiza bilineata |

Table A-8 (Continued)

BIRD SPECIES OBSERVED IN MOUNTAIN SPRINGS CANYON

| Common Name[1] | Scientific Name[1] |
|---|---|
| Sage Sparrow | Amphispiza belli |
| Dark-eyed Junco | Junco hyemalis |
| Chipping Sparrow[2] | Spizella passerina |
| Brewer's Sparrow | Spizella breweri |
| White-crowned Sparrow[2] | Zonotrichia leucophrys |

[1]Nomenclature in accordance with the Checklist of North American Birds (A.O.U., 1957) and its updates (A.O.U. 1973, 1976).

[2]Summer visitors, residents or migrants found exclusively in the riparian areas.

Table A-9

CHECKLIST OF MAMMALS CAPTURED OR OBSERVED IN MOUNTAIN SPRINGS CANYON

| Scientific Name | Common Name |
|---|---|
| Myotis californicus | California Myotis |
| Pipistrellus hesperus | Western Pipistrelle |
| Eptesicus fuscus | Big Brown Bat |
| Lasiurus cinereus | Hoary Bat |
| Plecotus townsendii | Townsend's Big-eared Bat |
| Tadarida brasiliensis | Brazilian Free-tailed Bat |
| Sylvilagus sp. | Cottontail |
| Lepus californicus | Black-tailed Jack Rabbit |
| Ammospermophilus leucurus | White-tailed Antelope Squirrel |
| Spermophilus beecheyi | California Ground Squirrel |
| Thomomys bottae* | Botta's Pocket Gopher |
| Perognathus longimembris | Little Pocket Mouse |
| Perognathus parvus | Great Basin Pocket Mouse |
| Perognathus formosus | Long-tailed Pocket Mouse |
| Dipodomys panamintinus | Panamint Kangaroo Rat |
| Dipodomys merriami | Merriam's Kangaroo Rat |
| Peromyscus eremicus | Cactus Mouse |
| Peromyscus maniculatus | Deer Mouse |
| Peromyscus crinitus | Canyon Mouse |
| Peromyscus boylii | Brush Mouse |
| Peromyscus truei | Pinyon Mouse |
| Onychomys torridus | Southern Grasshopper Mouse |
| Neotoma lepida* | Desert Woodrat |
| Neotoma fuscipes | Dusky-footed Woodrat |
| Canis latrans | Coyote |
| Vulpes macrotis* | Kit Fox |
| Bassariscus astutus* | Ringtail |
| Felis rufus | Bobcat |
| Odocoileus hemionus* | Mule Deer |
| Equus asinus | Feral Burro |

*Indirect observation by tracks, scats, nests, burrows.

Nomenclature follows that of Jones et al. (1979)

Table A-10

CHECKLIST OF REPTILES OBSERVED
IN MOUNTAIN SPRINGS CANYON

| Scientific Name | Common Name |
|---|---|
| Callisaurus draconoides | Zebra-tailed Lizard |
| Sceloporus magister | Desert Spiny Lizard |
| Uta stansburiana | Side-blotched Lizard |
| Eumeces gilberti | Gilbert's Skink |
| Cnemidophorus tigris | Western Whiptail |
| Lichanura trivirgata | Desert Rosy Boa |
| Masticophis taeniatus | Striped Whipsnake |
| Salvadora hexalepis | Western Patch-nosed Snake |
| Pituophis melanoleucus | Gopher Snake |
| Crotalus mitchelli | Speckled Rattlesnake |

Nomenclature follows that of Stebbins (1966).

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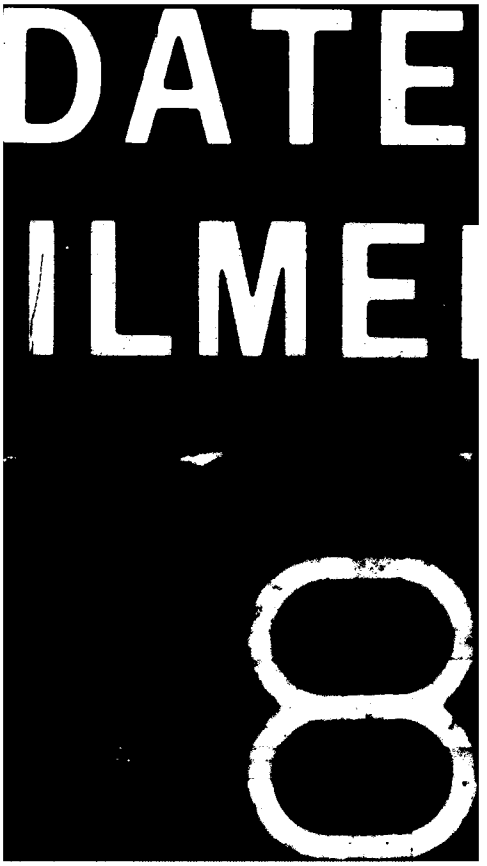
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